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This study examines the implications of the retention behavior of Air Force volunteer physicians on the Air Force's physician procurement policy. It examines the potential of the volunteer program to become a major and, perhaps, the principal source of physicians based on the retention behavior of volunteer physician accessions from FY1975 to FY1982. The analysis suggests that about one-half of the FY1987 authorized Air Force physician stock might be supported by the direct recruiting program for all groups except medical subspecialists. Predicted retention varies by specialty group, training, and grade (age): (1) Young board-certified surgeons and obstetricians, both U.S.- and foreign-trained are least likely to be retained under current conditions and are most responsive to an increase in military pay; (2) foreign-trained hospital-based physicians without board certification have the highest predicted retention rate; (3) foreign-trained subspecialists and surgeons are retained at a lower rate than U.S.-trained physicians in this group; (4) volunteer retention increases with the physician's military grade.

R-3185-AF

Retention of Volunteer Physicians in the U.S. Air Force

Victoria L. Daubert

February 1985

A Project AIR FORCE report
prepared for the
United States Air Force

PREFACE

This report analyzes the retention behavior of Air Force physicians who entered through the volunteer recruiting program and completed their initial obligation during fiscal years 1976 through 1982. It predicts the length of service for volunteer accessions in fiscal years 1980 through 1982 by medical specialty group and other important characteristics. Finally, it estimates the number of volunteer accessions that would be needed each year if the Air Force were to rely exclusively on volunteer recruiting to supply its physician force.

This research was part of the Project AIR FORCE project "Air Force Medical Resources Planning." The central purpose of the project was to examine physician and nonphysician provider manpower planning, integrating the conflicting demands of peacetime and wartime and recognizing the constraints on physician supply. The work was conducted for the Air Force Surgeon General under Rand's Resource Management Program.

In addition to the present report, the project has published a more general assessment of future physician supply conditions in S. D. Hosek, *Procurement of Air Force Physicians: Scholarship or Direct Recruiting?* (N-1968-AF). Other project publications include G. A. Goldberg, *Israeli Military Medical Experience: Ideas for the U.S. Air Force's Medical Service?* (N-1924-AF), and J. L. Buchanan and S. D. Hosek, *A Methodology for Evaluating Air Force Physicians' Peacetime and Wartime Capabilities* (N-1990-AF).

The study was prepared as a dissertation in partial fulfillment of the requirements of the doctoral degree in policy analysis at The Rand Graduate Institute. The faculty committee that supervised and approved the dissertation consisted of Chairman Charles R. Roll (Program Analysis and Evaluation, Office of the Secretary of Defense), Susan D. Hosek, and Daniel A. Relles.

SUMMARY

This study examines the implications of the retention behavior of Air Force volunteer physicians on the Air Force's physician procurement policy.

The volunteer recruiting program was a major source of Air Force physicians in the early postdraft years. In contrast to physicians from other procurement programs, volunteers as a group are heterogeneous with respect to age, training, and quality. Many of them are older or foreign-trained. In recent years the number of physicians recruited through the program has declined as physicians from the Armed Forces Health Professions Scholarship Program (AFHPSP) have entered active duty in increasing numbers.

Physicians recruited through the AFHPSP are expensive compared with the volunteers. This study examines the potential of the volunteer program to become a major and, perhaps, the principal source of physicians based on the retention behavior of volunteer physician accessions from FY1975-FY1982. Physician retention functions were estimated and used as a basis for predicting retention rates and profiles for FY1980-FY1982 accessions with three-year commitments.

The analysis suggests that, given the average of 7.16 years of service per volunteer physician predicted by this study and the average FY1977-FY1981 annual procurement levels (225 physicians per year), about one-half of the FY1987 authorized Air Force physician stock might be supported by the direct recruiting program for all groups except medical subspecialists.

Volunteer retention behavior appears to be responsive to changes in relative military and civilian earnings and an increase in the shortage specialty bonus could increase retention of needed surgeons. However, even moderately increasing the expected length of service by increasing military pay might substantially eliminate the cost advantage of the volunteer program over the AFHPSP.

A $10,000 increase in special pay beginning in the fourth year of service would increase the predicted length of service from only about four months for subspecialists to slightly over one year for hospital-based physicians.

Predicted retention varies by specialty group, training, and grade (age).

- Young board certified surgeons and obstetricians, both U.S.- and foreign-trained, are least likely to be retained under current

conditions and are most responsive to an increase in military pay.

- Foreign-trained hospital-based physicians (radiologists, anesthesiologists, pathologists) without board certification have the highest predicted retention rate.
- Foreign-trained subspecialists and surgeons are retained at a lower rate than U.S.-trained physicians in this group (most of whom are older).
- Volunteer retention increases with the physician's military grade, i.e., given years of training, the Air Force tends to keep older, more expensive volunteers.

Changing Air Force physician procurement policy to expand the role of the volunteer program as a substitute for all or part of the AFHPSP may not be feasible or advantageous. A full evaluation depends on the retention experience of other procurement programs and future civilian physician labor market conditions. It is necessary to more fully address physician quality criteria based on Air Force needs, which may differ from civilian sector needs.

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I. INTRODUCTION

The Military Health Services System (MHSS) is charged with maintaining a healthy, combat-ready active-duty force during peacetime and with providing necessary medical support during periods of mobilization and war. In addition, MHSS shall "create and maintain high morale in the uniformed services by providing a comprehensive and high quality uniform program of health services for members and other eligible beneficiaries." To provide quality health care services to the active-duty force and the large population of eligible beneficiaries (active-duty dependents, retirees and their dependents), the MHSS must recruit and retain a large staff of physicians. The Air Force alone maintains a staff of nearly 4000 physicians. Until 1973, the draft and the Berry Plan, a draft deferment program designed to ensure the preferred physician specialty mix, met this demand, but when the draft ended, the military services began to experience shortages in their physician staffs.

Maintaining the physician stock at the authorized level involves two interdependent factors: (1) how many physicians are recruited into the military service and (2) how long physicians are retained on active duty. The physician supply question has been the topic of several other studies (see, for example, Hosek [1] and Daubert, Relles, and Roll [2]). The present study examines the retention behavior of Air Force volunteer physicians recruited directly from the civilian sector and analyzes the implications of their retention behavior for the Air Force's physician procurement policy. Specifically, this report will assess the potential for expanding the role of the direct recruiting program to make it a major source of physicians for the Air Force.

Very little is known about the retention behavior of physicians in general and even less about physicians from the current procurement programs. The retention behavior of Berry Planners has been examined in the past. However, Berry Planners were draft motivated and have little in common with the current accession. Berry Planners' retention behavior is unlikely to shed much light on current physician accessions who chose military practice over some civilian alternative. Too few physicians from the other two major physician procurement programs, the Uniformed Services University of Health Sciences (USUHS) and the Armed Forces Health Professions Scholarship Program (AFHPSP), have completed their service commitments to support an analysis of their retention behavior. By this time, however, enough

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volunteers have joined the Air Force and faced the retention decision to examine their retention behavior.

The volunteer program was originally intended to augment the physician force in the early postdraft years, until physicians from other postdraft procurement programs began to enter active duty in sufficient numbers, and to decline thereafter. Although volunteer recruitment has recently declined, up to 500 physicians per year were recruited through this program in earlier years.

The USUHS program trains a small number of active-duty officers for a career as military physicians. Graduates are expected to remain on active duty for an average of 17.9 years.[3] The first graduates from USUHS joined the Air Force in 1974. The targeted number of Air Force USUHS accessions is 50 per year.

The AFHPSP provides medical school tuition and fees, and a monthly stipend to medical students enrolled in U.S. medical schools in return for one year of active-duty service for each year of scholarship support. The first few graduates from this program joined the Air Force in 1974 and accessions have increased slowly to meet the targeted number of about 400 physicians by 1985. Currently most AFHPSP graduates complete their training either in military or civilian residency programs before beginning obligated service. The Air Force estimates that AFHPSP graduates will serve an average of 8.6 years.[3]

Recruiting and training costs for USUHS and AFHPSP physicians are high compared to those for the volunteers[1] and Congress has recently reexamined these programs and raised questions about a possible change in status for the volunteer program. Can and should the less expensive volunteer program change from its present essentially supplemental function to a basic procurement program, perhaps even to the point of eliminating the AFHPSP? To help answer this question it is necessary to determine if volunteer physicians represent a viable alternative for future physician procurement. Substituting one program for all or part of the other requires that (1) volunteer physicians be acceptable (if not comparable) substitutes for AFHPSP physicians, using such criteria as quality of training, experience, age, and career potential and (2) enough volunteers, in the correct specialty mix to maintain the authorized physician stock, be recruited and retained at a cost below the current total cost of the two programs. The number of physicians who need to be recruited annually to maintain a given physician stock overall and in any given specialty depends, of

In 1980 the estimated direct USUHS costs per graduate were $245,000; AFHPSP average costs per graduate were $51,600. The recruiting costs per volunteer physician were $5900.

course, on accessions in prior years and on the expected length of service per accession, i.e., the retention rate.

The volunteers who joined the Air Force are different from the physicians recruited through the AFHPSP. AFHPSP physicians are a homogeneous group. All are recent graduates of U.S. medical schools who joined the Air Force immediately following their training. Volunteers, on the other hand, are a heterogeneous group with respect to age, training, and quality. Air Force personnel files show that over half the Air Force volunteers on active duty in FY1982 were graduates from foreign medical schools (FMGs). About one-third of the FMGs are U.S.-born, indicating that they may not have qualified for admission to U.S. medical schools. While foreign medical school training does not necessarily imply lower quality physicians, it has been shown to decrease civilian practice opportunities.[4] As a group, volunteers tend to be older when they enter active duty, particularly the U.S. graduates. The majority are not board certified. In recent years the number of foreign graduate accessions has decreased,[1] partly because of the tighter immigration policy and partly because of a reorientation of the Air Force's recruitment policy to limit FMG accessions. However, the total number of volunteers recruited has also declined substantially, permitting no conclusion as to whether FMGs can be replaced by U.S. graduates given current employment conditions, or what the marginal supply conditions for volunteers would be if they were to replace physicians from other procurement sources.

To analyze the implications of volunteer retention behavior on Air Force procurement policy, retention functions (representing the decision to remain in military practice following the initial tour of active duty) were estimated for volunteer physicians in the Air Force and used to predict long-term (ten-year) retention rates. The ten-year retention rates were predicted for volunteers as a group and for specialties, e.g., surgeons, who have been relatively more difficult to recruit and retain in the past. Group specific retention rates form the basis for determining the expected length of service for a given group of physicians. Group specific expected length of service is used to estimate the number of physicians who would have to be recruited annually to maintain a physician stock of a given size. The findings help to clarify the role and potential of the volunteer physician procurement program by providing estimates of the proportion and types of volunteers the Air Force can expect to retain. They also form the basis for policy options that might be effective in changing retention behavior in the preferred direction.

To accomplish these objectives, a behavioral model of retention, founded on the theory of occupational choice, was developed. The hypothesis which underlies the model asserts that the individual physician's decision to stay in or leave military practice depends on the relative level of utility he expects to derive from future military practice and his best civilian alternative. The utility of each alternative is presumed to depend on relative earnings and other characteristics of the two alternatives, as well as the personal characteristics and tastes of the individual physician. The physician data for this study come from Air Force personnel files for the years FY1975-FY1982. This part of the study is discussed in Sec. III.

Section IV describes the prediction of group retention rates using the retention functions developed in Sec. III. Long-term retention prospects, including expected years of service under two bonus levels, are discussed and related to marginal changes in program costs associated with the alternatives. Next, the level of accession requirements needed to maintain a given physician stock is examined and related to the past recruiting experience of the Volunteer Procurement Program.

The study's findings show that, consistent with earlier expectations, [5] volunteer physicians are retained beyond their commitment at substantially higher rates than physicians procured through the draft era Berry Plan and, based on current evidence, through the AFHPSP. Up to about one half of the Air Force's authorized physician stock might be supported by the direct recruiting program. Volunteer physicians are responsive to changes in relative military earnings and their retention might be increased still further through more generous military compensation. The study suggests that the most cost effective method of increasing retention of specialists in short supply, e.g., surgeons, might be to target pay increases to specific specialty groups through increases in the shortage specialty bonus and the board certified bonus.

Before proceeding with the analysis, Sec. II describes the problem of physician retention in the context of the civilian and military environment and examines how future changes in this environment might affect military physicians.

II. THE PROBLEM OF PHYSICIAN RETENTION

Retaining physicians in the military services was difficult during the draft years as well as in the All-Volunteer Force.

Although there is no conclusive evidence on physicians' attitudes about military practice and retention behavior, several factors emerge as consistently affecting physicians' decisions to stay in or leave military practice. The most important appears to be the difference in what physicians believe they can earn in a civilian practice and their military incomes. The military assignment policy of frequent moves and uncertain locations is a very close second. The third area is what has been referred to as the "military atmosphere," which includes such factors as perceived regimentation, lack of control over one's patients, lower status, and inadequate opportunity for professional development.

There is, however, growing evidence that a physician surplus is developing rather rapidly in the civilian labor market and that physicians are beginning to adjust their practice modes accordingly. Whether the Air Force will become more competitive in this environment is not clear. Before taking a closer look at the changes in civilian labor market conditions, the issue of physician earnings will be discussed further.

RETENTION AND PHYSICIAN EARNINGS

During the late 1960s and early 1970s the military services became increasingly concerned over the losses of their career medical officers. No data were available for the Air Force or Navy, but in the Army income appeared to be the largest factor in the rapid increase in career physician losses.[6]

A 1966 survey of 2425 Army Medical Corps officers showed that dissatisfaction with an Army career appeared to be primarily related to lower pay, frequent moves, and perceived lower status. These factors influenced different officers to different degrees.[7]

By 1972, only one-sixth of all active-duty military physicians were careerists, serving on active duty from 10 to 20 years; two-thirds were obligated Berry Plan physicians who had been granted a draft deferment until the completion of their training; and the remaining one-sixth were completing residency training in military teaching hospitals.

This era of heavy career losses and almost nonexistent first-term retention occurred during the mid-1960s and early 1970s, perhaps in

part because of the Vietnam war, but probably to a larger extent because of the very rapidly changing civilian medical care market. Although physicians' civilian earnings opportunities had traditionally exceeded their military earnings, the earnings gap began to widen rapidly during this period, reflecting a sharp rise in national health expenditures and in the volume of health services provided. Between 1960 and 1971 national health expenditures more than tripled. They increased from 25.9 billion dollars to 84.7 billion dollars, or from 5.2 percent of GNP in 1960 to 7.7 percent of GNP in 1972.[8] The single most important catalyst for this unprecedented rise was the post-World War II growth of various forms of voluntary health insurance. By the end of 1972 about 80 percent of the population under 65 had some form of medical insurance and the 1965 passage of Title XVIII (Medicare) and Title XIX (Medicaid) of the Social Security Amendments provided coverage for the elderly and for some of the poor. The availability of insurance led to a sharp increase in the demand for medical care and in medical care prices. Physician incomes rose at a faster rate than physician fees, reflecting the steady increase in the volume of services provided.[9] By 1970, the major adjustments in the market had apparently taken place, and increases in physician incomes began to level off after 1970 to more closely reflect the rise in the Consumer Price Index (CPI).[10]

To stem the loss of career officers, to increase the retention of active-duty physicians then completing their obligated service periods, and to attract volunteer physicians from the civilian sector, the Variable Incentive Pay (VIP) program was enacted in 1974. It authorized a new bonus for military medical officers depending on their procurement source, years of service, and additional active-duty commitments. At the time it was enacted, this bonus narrowed the gap in income between military and civilian physicians with comparable experience.

The new VIP program helped to decrease the losses of career physicians and retention rates of career medical officers remained fairly constant after 1974.[6] Retention at the end of the initial commitment increased sharply for all military physicians, including Berry Planners, although in most cases it was limited to one additional year. However, bonuses under the VIP program were not protected against inflation and the incentive value of the program decreased fairly rapidly as a result.

In 1980, PL 96-284 again revised the special pay provision for military physicians effective FY1981. This special pay schedule depends on years of training, specialty, board certification, and civilian and military experience. The amount of special pay ranges from $14,000 to about $30,000 per year. Compared to the old bonus structure, the new

special pay schedule more closely resembles relative civilian earnings among specialists by rewarding board certification and by discriminating on the basis of scarcity. However, the overall level of military earnings for most specialties, particularly for surgeons and hospital-based physicians remains substantially below median civilian earnings. Whereas military physicians seldom earn over $60,000, the median 1981 civilian physician practice earnings were $86,210. General practitioners had the lowest median civilian incomes ($63,950), and orthopedic surgeons had median civilian earnings of $135,690. Yet, in military practice, given grade and years of service, a board certified orthopedist can earn a maximum of only $13,000 more than a general practitioner. This earnings gap is clearly a major reason for the greater difficulty of retaining surgeons.

CHANGES IN CIVILIAN LABOR MARKET CONDITIONS

Are physician civilian opportunities likely to change in the future and how might these changes affect the decision of military physicians to remain in or leave the service?

A recent study by the Graduate Medical Education National Advisory Committee (GMENAC), commissioned by the Department of Health and Human Services, estimates a surplus of 59,000 physicians in the United States by 1990 and, if medical school enrollment is allowed to grow at its current rate, the projected physician surplus could reach 130,000 by the year 2000. The demand for physicians in 1990 is estimated to be between 415,000 and 488,000 physicians.[11] The report predicts surpluses in general surgery, ob/gyn, and several other specialties.

However, a "surplus" of civilian physicians per se may not positively affect the retention of military physicians as long as civilian physicians' incomes remain high. Increasing physician supply does not necessarily imply decreasing incomes. In 1979, 25,000 more physicians provided patient care than in the previous year (approximately a 6 percent increase), while patient visits decreased 9 percent and the average fee increased only 9.4 percent, well below the rate of inflation. Yet, 1979 physicians' earnings data show not only the highest annual increase in the last decade but also the first increase in real terms since 1976. The increase in earnings appears to result from an increase in the average number of chargeable services per visit, largely determined by policies of health service providers and third-party payors.

Several recent studies of medical students' specialty choices and views regarding the future of their profession reflect some awareness of

the changing conditions in the physician labor market. Students acknowledge the possibility of a more limited professional future than was enjoyed by physicians in the past.

In a 1977 study of medical students' specialty preferences and specialty choices, Matteson and Smith [12] found that the perceived demand for a given specialty was an important factor in specialty ch ice, causing many students to choose a specialty other than the one they preferred.

Ginzberg and Braun [13] found that many students expressed a somewhat pessimistic view of the medical profession's (if not their own) future attributable to a variety of changes in society in general and in the physician labor market in particular. Most felt that physicians' opportunities to practice medicine might in some way be affected by these changes. The students' overwhelming desire to specialize and avoid primary care reflected the expectation that physicians in primary care would be doomed to a boring practice and little respect from members of their profession. Those students who addressed the issue of physician supply expressed concern over the following factors: increased competition, less freedom of choice for doctors, an increase in salaried positions, a possible decrease in earnings, and an increase in bureaucratic control.

The recent growth of Health Maintenance Organizations (HMOs) and other types of prepaid group practices was probably aided by the physician surplus and increased competition among practicing physicians. Between 1980 and 1981, enrollment in HMOs alone increased over 13 percent [14] and a recent analysis by *Medical Economics* predicts that by 1990 close to 30 percent of physicians will be associated with some type of prepaid group practice, to avoid losing patients. A survey of physicians whose patient visits per week had declined in the past five years found that 36 percent blamed the decline on increased competition from other providers.[15, p. 62] Because prepaid plans' profits depend on controlling the utilization of services, fewer physicians may be needed to serve a given population than would private practice providers who have no incentive to control utilization. Thus, the growth in prepayment could further contribute to a physician surplus. Primary care physicians are most likely to suffer from increased competition as underutilized specialists broaden their scope of services to include some primary care and thus make up for their lower volume.

A 1978 *Medical World News* poll reported that 32 percent of physicians favor HMOs, while 48 percent oppose them. Younger MDs were significantly more likely to favor HMOs.[16] Many of the advantages of HMOs (regular working hours, malpractice coverage, paid fringe

benefits including retirement,[1] medical backup, guaranteed income) cited by the physicians in this poll are attributes of military practice as well. The same generally holds for some of the disadvantages cited such as less choice in treatment of patients, reduced income, and less choice of office location.

HMOs probably constitute the civilian practice alternative closest to military practice, although important differences remain, in income, choice of practice location, stability, and the civilian versus military environment. The effects of the rapid growth of HMOs on retention are difficult to predict. It is possible that physicians will be retained in military practice at the same rate and that only the civilian choices of those who leave will be affected, i.e., more might choose HMOs. On the other hand, the increase in alternative modes of civilian practice may affect military physicians who may have preferred military practice only over certain types of civilian practice (perhaps private practice), but who might choose HMOs. Such a scenario could conceivably change the relative retention of given specialty groups as well.

In addition to the trend toward HMOs, there is evidence that physicians are locating their practices in what have traditionally been considered less desirable rural areas and small towns,[17] locations which are characteristic of many Air Force facilities. This trend too might create more, although not necessarily more desirable, alternative civilian choices for military physicians.

Having considered some of the conditions and potential changes in the military and civilian environments relevant to physicians' practice opportunities and choices, the discussion will now turn to a theoretical model of how career choices might be made by an individual—in particular, by a physician considering a change from Air Force to civilian employment.

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[1]Because the majority of volunteers enter active duty after age 40, they will not qualify for retirement benefits, which require 20 years of service (retirement age is 60).

III. A MODEL OF VOLUNTEER RETENTION BEHAVIOR

Section III estimates a behavioral model of physician retention. It first describes a theoretical model of how individuals might choose between alternative courses of action, and, specifically, how physicians might choose between remaining in or leaving military practice. After describing the sources of the data from which the retention model was estimated and some sample characteristics, the empirical model and its variables are discussed and related to the sample characteristics. Empirical results are then presented.

THE THEORETICAL MODEL

The theory of individual qualitative choice behavior has been applied to a wide range of topics, including enrollment choices in HMOs,[18] medical specialty choice,[19] choice of college,[20] choice of travel mode,[21] choice of financing medical school education,[2] and choice of occupation. The theory asserts that when faced with a choice among a finite set of alternatives, an individual can rank these alternative opportunities in the order of his preference and choose the one he considers best, given his taste and other constraints relevant to his decision, e.g., age, education, and income. Statistical techniques commonly used to estimate the parameters of these models are logit analysis for binary dependent variables, and conditional logit analysis for dependent variables with more than two possible responses.[22]

The logit technique allows the prediction of probabilities for the possible values of the dependent variable directly from a set of explanatory variables based on individual observations. McFadden [22] and Nerlove and Press [23] have discussed the maximum likelihood estimation of these models.

The model developed below seeks to describe how volunteer Air Force physicians decide whether to continue in active-duty military practice, or to seek alternative civilian employment.[1]

Each individual physician will try to maximize his returns from employment. Given his personal characteristics (P_i), he will subjectively rank available employment opportunities according to their

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[1]Strictly speaking, the officer will choose between continued Air Force practice and his best alternative, including both civilian and other military opportunities.

money income (Y) and other characteristics of employment (E) he cares about. He chooses the alternative that he expects will yield the largest utility or return:

$$U_i = f(Y, E; P_i)$$

Similarly, an individual who is already employed will evaluate his current employment relative to a set of available alternative employment opportunities, or relative to the "best" alternative employment opportunity. He would want to remain in his present employment if he perceived the sum of the monetary and nonmonetary returns to be at least equal to the returns he would expect to receive from his "best" alternative (considering also any monetary and nonmonetary cost of an employment change).

Following from this framework, at the end of each year of active duty a physician faces two choices: He can continue military practice or instead choose his "best" civilian alternative.

Let M be a vector of characteristics of military employment including income and let C be a vector of characteristics of civilian employment including income. The individual's continuation decision will depend on a comparison of the subjective utilities (U_m, U_c) he receives from M and C, where

$$U_m = g_m(M, P_i)$$

$$U_c = g_c(C, P_i)$$

Following McFadden,[22] an individual with characteristics P_i perceives his utility from military or civilian practice as

$$U_c = g_c(C, P_i) + V_c$$

$$U_m = g_m(M, P_i) + V_m$$

where V_m and V_c are independent error terms.

If individuals for whom $U_m \geq U_c$ choose military practice, their probability of continuing on active duty for an additional year is given by

$$P(R \mid M, C, P_i) = P_i(U_c - U_m \leq 0 \mid M, C, P_i)$$

$$= P\left[V_c - V_m \leq g_m(M, P_i) - g_c(C, P_i) \mid M, C, P_i\right]$$

$$= F\left[g_m(M, P_i) \quad g_c(C, P_i)\right]$$

where F is the c.d.f. of $(V_c \quad V_m)$.

Assuming that the difference of random errors follows a logistic distribution[2] and that the nonrandom part of the utility function $g_m(M, P_i) \quad g_c(C, P_i)$ is linear in the parameters, the probability of choosing military practice is given by the following expression:

$$P_R \quad \frac{1}{1 + e^{-\beta X}}$$

where $\beta X \quad g_m(M, P_i) \quad g_c(C, P_i)$.

The cumulative logistic distribution function can be estimated using the maximum likelihood technique which chooses the set of parameters (bs) with the greatest chance of generating the given sample. Suppose that for each individual i, a vector, X^i, of individual characteristics, and the individual's retention decision, r^i, equaling either 0 or 1, are observed. Then the maximum likelihood estimate of the vector b is the value of b which maximizes the following expression:

$$\text{Max } \prod_i [f(X^i, b)]^r [1 \quad f(X^i, b)]^{(1 \ r)}$$

The estimation is accomplished by using an iterative numerical procedure to maximize the likelihood function.[23]

The theoretical model considered above provides the foundation for the empirical model of physician retention behavior and for the estimation of retention functions which will be discussed next. The estimation begins by identifying the analysis data sources, and by briefly describing how the final data file was constructed.

DATA SOURCES

The principal source of data for this study was the Air Force *Uniformed Officer Record* (UOR), FY1975-FY1982. The UOR for any given year provides detailed individual personal and service information on all officers. including physicians serving in the Air Force for all or part of the year. The original Air Force *Uniformed Officer Record* included 5110 physicians who had entered active duty between July 1974 and September 1981, i.e., FY1975-FY1981. Of these 1627 were AFHPSP participants, 1606 were volunteers, and 1362 were Berry Planners; 511 came from other procurement sources and were excluded

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[2]For example, McFadden assumes that if the errors are independent and each has a Weibull distribution, the difference of the errors follows the logistic distribution.

from the file. To observe the retention behavior of FY1975-FY1981 volunteer physician accessions over their period of military service, a longitudinal physician file for FY1975-FY1982 was created by extracting all physician records for each of the eight years and linking them. The eight annual files were concatenated and then sorted by physician ID and year. The final file contained from one to eight consecutive records for each physician, one for each year on active duty between FY1975 and FY1982.

The UOR physician file sample used to estimate volunteer physician retention in the Air Force includes 1405 physicians who:

    a.   Are fully trained volunteers recruited directly from the civilian sector, and

    b.   Joined the Air Force between July 1974 and September 1981.

One hundred seventy-four physicians who had received one or more years of training while on active duty were eliminated from the sample. In addition, 27 physicians whose length of commitment could not be determined were excluded from the final sample.

Of the 1405 physicians in the final sample, those having three-year commitments constitute the largest (and in terms of future accessions probably the most representative) group in the sample ($N = 781$). Table 1 shows the total number of physicians (and, in parentheses, those with three-year commitments) in each accession cohort by service year group.

Note that successive year groups in the sample are based on successively fewer accession cohorts, i.e., year group 0-1 includes accessions who entered the Air Force between FY1975 and FY1981 whereas all physicians in year group 5-6 entered in FY1975 or FY1976. Ideally, one would have complete data on all cohorts and be able to follow a cohort over successive years. However, over the time period observed, FY1975-FY1981, the accessions in any one cohort were too few to support the analysis of retention behavior undertaken by this study (see Table 1). For this reason, the different cohorts were combined and analyzed according to their years of service since they last joined the Air Force.

The UOR data were supplemented with data from two other sources:

• The *Uniformed Services Almanac*, 1976-1983, provided military earnings data. The military income measure includes regular military compensation (RMC), now called basic military com-

Table 1

TOTAL SAMPLE PHYSICIAN ACCESSIONS COHORT BY SERVICE YEAR GROUP,
FY1975-FY1981
(3-year obligors in parentheses)

Cohort Entry Fiscal Year	All Accessions	Service Year Group					
		0-1	1-2	2-3	3-4	4-5	5-6
1975	137	137	133	130	89	70	63
	(20)	(20)	(19)	(18)	(17)	(11)	(11)
1976	395	395	381	365	246	192	162
	(122)	(122)	(117)	(112)	(97)	(64)	(54)
1977	272	272	262	239	220	113	
	(236)	(236)	(225)	(205)	(190)	(92)	
1978	204	204	187	181	167		
	(179)	(179)	(162)	(157)	(147)		
1979	155	155	150	139			
	(107)	(107)	(103)	(98)			
1980	150	150	147				
	(74)	(74)	(72)				
1981	92	92					
	(43)	(43)					

SOURCE: Air Force Uniformed Officer Record, FY1975-FY1981.

pensation (BMC),[3] and all applicable special pay. RMC/BMC depends on the physician's grade (discussed below). Special pay depends on training, specialty, board certification, and prior service in the military or National Health Service Corps. Special pay varied from $14,000 to $26,500 for the physicians in the sample, accounting for almost one-half of total compensation. This military income measure very closely reflects the individual's actual military earnings given his grade and years of service (although not perfectly because allowances are based

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[3]RMC combines basic pay and allowances and the federal tax advantage due to nontaxable allowances. BMC does not include the Variable Housing Allowances (VHA) paid to about one-third of all active-duty personnel living off base in the continental United States. See Ref. 24.

on group averages within grade and years of service for both married and single personnel).[4]

- *Medical Economics* Annual Physicians' Earnings Survey, 1975-1982. The civilian income measure used in the study is median income by specialty for full-time office-based physicians based on the 1979 Annual Physicians' Earnings Survey published by *Medical Economics.* The 1979 physician income figures provided median incomes separately for 11 specialty groups, surgical specialties, and nonsurgical specialties. Based on an AMA survey [10] which found that physicians' incomes had remained fairly stable in real terms between 1970 and 1980 (they had declined 2 percent between 1975 and 1979), and the 1975 to 1981 Physicians' Earnings Surveys published in *Medical Economics,* which showed that relative incomes among specialists had not changed significantly, the 1979 earnings were adjusted by changes in the Consumer Price Index [25] to obtain the 1975-1982 civilian physician earnings data. This method allowed the grouping of physicians into 13 earnings categories rather than the usual eight groups for which annual earnings profiles were published prior to 1982. (Compared with the 1982 median physicians' earnings data [26] median civilian earnings were misestimated by a maximum of −4 percent for surgical specialties and by a maximum of +7 percent for nonsurgical specialties and primary care physicians.)

The most serious shortcoming of earnings data based on group medians is that it treats all physicians in the same specialty (or worse yet, specialty group) as if they had the same civilian earnings opportunity—clearly a faulty premise.

Individual civilian earnings vary for several reasons: We know that board-certified physicians can expect higher civilian earnings than those not board certified. In a recent study, Wilensky and Rossiter [27] examined the economic advantages of board certification. Based on 1977 data, they found that board-certified physicians in private practice in each specialty group had higher average earnings than those in the same specialty who were not board certified. However, only pediatrics and surgery showed statistically significant differences, with differences in mean income of 29 percent and 44 percent, respectively. Overall, their findings show that board certification increased mean

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[1]Military income will be underestimated when physicians receive a promotion in the year after they make their continuation decision. Because this information is only available retrospectively for physicians who continued, it would bias the effect of income on retention. Expected military income is adjusted for increases based on additional years of service.

income by about \$13,000. This difference is not accounted for in the civilian income measure.

Next, there are substantial regional earnings differences. The 1982 median earnings by region [25] are shown in Table 2. Physicians in the southern United States earned over 15 percent more than those in the East. Overall, median earnings in the mid-southern states (highest earnings) were 21 percent above those in the New England states. Although it would have been possible to adjust the civilian earnings based on average regional differences, this was not done because of lack of data on the physician's practice location before joining the Air Force or following his separation. Despite the shortcomings in the earnings measure discussed above, median civilian earnings provide a reasonable proxy for individual earnings opportunities, especially with regard to the relative earnings opportunities among specialties.

THE EMPIRICAL MODEL

Based on the theory of occupational choice discussed earlier, the following model was estimated from data based on the sample of volunteer physicians. The model represents the individual physician's decision to continue military practice for one additional year $(t + 1)$ after completing the current year (t). The continuation decision $P(t + 1 \mid t)$ was estimated for the entire sample of volunteers for service years 2, 3, 4, 5. In addition, the continuation decision was estimated separately for volunteers with three-year commitments (see following subsection). Each individual was included in each regression until one year after leaving active duty.

Table 2

PHYSICIANS' MEDIAN CIVILIAN EARNINGS
BY REGION, 1982

Region	Median Earnings
South	98,410
Midwest	96,810
West	88,330
East	85,290

SOURCE: *Medical Economics*, 1982 Physicians Earnings Survey, September 19, 1983.

The estimated model of volunteer physician retention took the following form:

$$P(t + 1 \mid t) = \text{Observed individual continuation decision } (0,1) \text{ at}$$

$$t + 1 \text{ years of service given } t \text{ years of service}$$

$$(t = 2, 3, 4, 5)$$

$$= 1/(1 + \exp(b'X))$$

where the independent variables are as defined below.

Choice of Variables and Sample Characteristics

Physicians' practice choices are assumed to depend on two types of variables: those that describe the individual physician's personal characteristics such as his specialty, training, age, and sex and those that describe the practice choices such as income, assignment, and grade.

Before discussing the independent variables in the model, this subsection specifically examines the reasons for estimating the conditional retention rate $P(t + 1 \mid t)$[5] and using it to derive the unconditional retention rate[6] for a given service year rather than estimating the unconditional retention rate directly.

The discussion of the independent variables begins with the group of attributes controlling for the physician's length of commitment. The reasons for estimating the model separately for those with three-year commitments are given. Choice of the earnings variable is followed by the groups of attributes that control for the physician's civilian and military practice settings and personal characteristics. The empirical results conclude Sec. III.

The Observed Individual Conditional Retention Rate
[$P(t + 1 \mid t)$]

The interesting measure in this study is how many years the Air Force can expect physicians to remain on active duty. The observed

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[5] The conditional retention rate gives the probability that the physician will continue in military practice for at least one more year, given that he has completed the current year.

[6] The unconditional retention rate for any year t gives the probability that a physician who entered active duty will be retained for at least t years.

Variable	Definition
C1	1 if the physician had a 1-year commitment; 0 otherwise
C2	1 if the physician had a 2-year commitment; 0 otherwise
C4	1 if the physician had a 4-year commitment; 0 otherwise
LEINCR	Natural log of the expected military and civilian earnings ratio
PRIMSPEC	1 if the physician is a surgeon or ob/gyn; 0 otherwise
SPCLTY	1 if the physician is in surgical or nonsurgical subspecialty; 0 otherwise
HSPBSD	1 if the physician is a radiologist, pathologist, or anesthesiologist; 0 otherwise
FMG	1 if the physician graduated from a foreign medical school; 0 otherwise
OSTEOP	1 if the physician is an osteopath; 0 otherwise
BOARDS	1 if the physician was board certified in year t; 0 otherwise
GR4	1 if the physician is a major (04) in year t; 0 otherwise
GR5	1 if the physician is a lt. colonel (05) in year t; 0 otherwise
GR6	1 if the physician is a colonel (06) in year t; 0 otherwise
CITF	1 if the physician was assigned to a foreign country in the year of his retention decision; 0 otherwise
SQRTAGE	The square root of age at year t.

Each variable or group of variables is discussed below.

retention rate for a given service year t reflects the physician's decision to remain on active duty for t years, given that he entered military service.

The observed conditional retention rate (also called the continuation rate) reflects each individual physician's decision to remain on active duty for $t + 1$ years, given that he has already served t years. Estimating the continuation rate instead of directly estimating the retention rate from the data seemed preferable for the sample of volunteer physicians because the retention rate at the end of the initial commitment (ranging from one to four years for the physicians in this sample) would distort the actual expected length of service for two reasons: First, it would fail to capture the 18 percent of volunteers in the sample who left before completing their commitment. Second, physicians who were retained past the initial commitment might not necessarily stay. Seventeen percent of the physicians in the sample left within six months of the end of their commitment. Table 3 shows the retention profile for volunteer physicians whose commitments ended before September 1981. Just over half of the 18 percent of volunteers who did not complete their commitment left one or more years before the end of their obligation.

Foreign Medical Graduates (FMGs) seem more likely to leave soon after joining. Of the 356 three- and four-year committed FMGs, 10 percent left within the first year whereas only 7 percent of the 282 three- and four-year committed U.S. graduates left within the first year.

Some of the volunteers who left before their release date probably left the Air Force involuntarily, especially those who remained on active duty only a short time before leaving. Because there is no reliable way to separate voluntary from nonvoluntary leavers, the 180 observations in this category are suspect and should probably not be included in modeling the retention decision as a behavioral choice of physicians.

On the other hand, these physicians should not be excluded from consideration in the Air Force's procurement policy. The large number of early separations may indicate that the Air Force might have used a more stringent selection process, with respect to its own or the prospective physician's expectations. High physician turnover is not without cost, both monetary and nonmonetary, and the high loss rate should be taken into account explicitly, rather than buried in an overall retention rate that implicitly assumes that all accessions will complete at least their period of commitment when many, in fact, do not. Expected years of service and costs per accession could be signifi-

Table 3

OBSERVED RETENTION OF VOLUNTEERS IN THE SAMPLE WHOSE
COMMITMENT ENDED BETWEEN FY1976-FY1981

Commit-ment Ended in Fiscal Year	Total Number of Physicians in Year Group	Number of Physicians Who Completed Obligation	Physicians Who Left Before FY1981					Number of Physicians Retained Beyond FY1981
			Number of Months Retained					
			1-6	7-12	13-18	19-24	-24	
76	33	32	8	1	5	2	2	10
77	125	111	10	8	3	11	26	19
78	189	162	16	10	5	20	25	33
79	159	124	12	16	4	7	1	28
80	284	220	16	18	5	4		28
81	217	183	13	1				76
All	1012	832	75	54	22	44	54	194

NOTE: Length of commitment ranged from one to four years.

cantly over or underestimated. For example, the observed retention
rates in Table 4 show that omitting early leavers from the retention
analysis and applying the retention rate to all new accessions would
underestimate eventual losses by 29 percent for the volunteers in this
sample whose commitment ended in FY1979.

To more accurately capture actual attrition and retention behavior
of Air Force physicians, this study estimates four separate continuation
equations from the data representing the continuation decision at the
end of two, three, four, and five years of service, respectively. Year
group t (t = 2-5) includes all physicians who completed t years of ser-
vice. Physicians who served at least 10 additional months were defined
as stayers ($P(t+1 \mid t)$ was set equal to one); those who served fewer
than 10 additional months were defined as leavers ($P(t+1 \mid t)$ was set
equal to 0). Table 5 shows the observed continuation rates and reten-
tion rates for the sample by service year group. These rates represent
the continuation rates (conditional retention rates) of all cohorts after
a given number of years of service, regardless of the length of
commitment and regardless of whether the commitment has been com-
pleted. In contrast, Table 4 above shows the retention rates at the end
of the initial commitment. Observed retention at the end of initial

Table 4

OBSERVED INITIAL RETENTION OF AIR FORCE
PHYSICIANS BY COMMITMENT YEAR
(FY1976-FY1981)

Commitment Ended in Fiscal Year	Initial Retention	
	As Proportion of Total Accessions	As Proportion of Accessions Who Completed Their Obligation
1976	.848	.875
1977	.616	.694
1978	.577	.673
1979	.430	.553
1980	.251	.322
1981	.421	.500

NOTE: Retention is measured at the end of initial commitment. Commitments vary from one to four years, i.e., different entry cohorts are included for each commitment year, and retention is measured after differing lengths of service.

Table 5

OBSERVED SAMPLE CONTINUATION
RATES FOR VOLUNTEERS IN
SERVICE YEAR GROUPS 0-6

Service Year Group	Observed Continuation Rate	Observed Retention Rate
0-1	.97	.97
1-2	.95	.92
2-3	.83	.76
3-4	.66	.50
4-5	.86	.43
5-6	.94	.41

NOTE: Service year groups include physicians with commitments ranging from one to four years.

commitment fell sharply in FY1980, reflecting partly the lower retention rates of all physicians with three-year commitments and partly the very low observed initial retention for FMGs in FY1980. At only 18 percent of total accessions, it was the lowest rate for all years studied and may be partly explained by the changing Air Force policy toward foreign medical graduates and their replacement by physicians from the AFHPSP. The observed initial retention rate for graduates from U.S. medical schools in FY1980 was .33, almost twice that of FMGs.

Length of Commitment [C1, C2, C4]

The length of commitment for volunteers in the sample varies from one to four years. Although official Air Force policy calls for a minimum three-year commitment and a four-year commitment for special assignments and for those with previous service, in the early years of the program (FY1975-FY1976), the majority of accessions (61 percent) had one- and two-year commitments.

The shortage of military physicians was most severe in the early postdraft period and the Air Force was willing to accept short-term commitments to meet their requirements. It is possible that there are some fundamental differences between the physicians recruited then and the ones recruited in later years. These differences may cause retention behavior to vary between the groups, i.e., they may come from different populations.

Shortages of general practitioners were especially acute in the early years because these physicians had been drafted annually as needed, whereas specialists had been and for several years continued to be procured through the Berry Plan. Abolishing the draft created a gap in the primary care area until general practitioners from the AFHPSP came on active duty.[7] The first year in which sizable numbers of volunteers were recruited was 1975, largely one- and two-year committed physicians. In 1977 there was, for the first time, a large number of physician accessions with three-year commitments and a drastic drop of those with one- and two-year commitments. Subsequently, three-year commitments predominated although some two-year commitments continued (10 percent for FY1977-FY1980).

Table 6 shows that in all year groups, except year group 5, which includes only pre-FY1977 accessions, the three-year obligors comprise the largest group in the sample. Because most future volunteer accessions are likely to have three-year commitments and because of the

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[7] The initial policy was to allow only 50 percent of HPSP graduates to enter residency training.

Table 6

DISTRIBUTION OF PHYSICIANS IN THE SAMPLE BY
SERVICE YEAR GROUP AND LENGTH OF COMMITMENT
(Percent)

Service Year Group	Length of Commitment (years)				
	1	2	3	4	All
0	3	26	59	12	100
1	5	26	58	11	100
2	8	25	57	10	100
3	6	20	64	10	100
4	8	32	45	15	100
5	13	41	29	17	100

uncertainty regarding the one- and two-year obligors, physicians with three-year commitments in the sample will also be examined separately.

The average length of commitment was almost equal for U.S. graduates (2.84 years) and FMGs (2.71 years), but FMGs had more three-year commitments and far fewer four-year commitments than U.S. graduates (see Table 7). This is not surprising because FMGs, most of whom are foreign-born, are less likely to have had prior military service.

Table 7

FY1975–FY1981 FMG AND U.S. GRADUATE ACCESSIONS
IN THE SAMPLE BY YEARS OF COMMITMENT

	Years of Commitment				
	1	2	3	4	All
U.S. graduates	52 (7.68%)	166 (24.52%)	318 (46.97%)	141 (20.83%)	677 (100%)
FMGs	37 (5.08%)	194 (26.61%)	472 (64.75%)	26 (3.57%)	729 (100%)
All	89 (6.33%)	360 (25.60%)	790 (56.19%)	167 (11.87%)	1406 (100%)

Observed initial retention for physicians in the sample varied by years of commitment from a high of .94 for physicians with one-year commitments to a low of .48 for physicians with three-year commitments. (See Table 8.)

Physicians with four-year commitments are likely to be retained at a higher rate because their expectations of military practice are probably more realistic, given their prior service experience. In addition, because their prior years of service count toward their retirement eligibility (20 years of active duty), they can qualify for retirement benefits in fewer years. Table 8 shows the proportion of physicians in each commitment group by year group.

Completing the commitment was inversely proportional to the length of commitment, ranging from a high of 100 percent for one-year commitments to a low of 83 percent for four-year commitments. (However, although those with one-year commitments had the highest observed rate of completing the commitment, their observed retention rate is substantially lower for all subsequent years.) For three years of service and more, two- and three-year obligors' observed retention rates are equal.

Table 8

AVERAGE OBSERVED SAMPLE CONTINUATION AND RETENTION RATES
BY SERVICE YEAR GROUP AND LENGTH OF COMMITMENT

Service Year Group	Years of Commitment			
	1	2	3	4
0	1.00 (1.00)	.98 (.98)	.97 (.97)	.96 (.96)
1	.94 (.94)	.95 (.93)	.95 (.92)	.95 (.91)
2	.54 (.51)	.61 (.57)	.95 (.87)	.94 (.86)
3	.72 (.37)	.84 (.48)	.55 (.48)	.97 (.83)
4	.97 (.35)	.86 (.41)	.86 (.41)	.82 (.68)
5	.93 (.33)	.96 (.40)	.94 (.39)	.92 (.63)

NOTE: Retention rates are given in parentheses.

Military/Civilian Income Ratio [LEINCR]

This study uses an approach commonly found in the context of supply and retention of military manpower [McCall and Wallace, 1967; Fisher, 1969; Enns, 1975; Gotz and McCall, 1979; Chow and Polich,

1980]. The decision to join or remain in the military is assumed to be based on a comparison of military earnings and the best civilian alternative. Using the natural log of the earnings ratio rather than entering the natural log of military and civilian earnings separately implies that the military and civilian earnings coefficients are equal but of opposite signs,[8] and that the relationship between military and civilian earnings is not expected to change over the period of future service (see Table 9).

When a physician chooses between continuing military practice and seeking civilian employment, his decision will be influenced by the expected relative return from the alternatives. Income clearly represents a large portion of the overall return from employment.

How can a physician estimate his future earnings? It is plausible that he would base his expectations on the earnings of others with similar characteristics. In the military setting a physician will generally know what his future income will be based on grade, years of service, and eligibility for bonuses. Although changes in the pay and bonus structure, such as the 1980 special pay bill, can cause periods of uncertainty before passage, physicians generally have fairly reliable information on upcoming changes in pay or bonus legislation which would affect them.

Their expected civilian income will be harder to estimate. The only available measure of civilian income is median practice income of office-based physicians by specialty group, published annually by *Medical Economics* (for a further discussion of the civilian earnings measure see the subsection on Data Sources). Median earnings are probably a reasonable overall estimate of the relative civilian earnings opportunities between specialty groups. However, most physicians who contemplate leaving military practice for a civilian career are likely to try to obtain more accurate information about their own individual civilian earnings opportunities. As a result of this search, many physicians will know quite well how their best actual civilian opportunity compares to their military opportunity and their decision will be made accordingly.

Median physician earnings do not account for differences in earnings opportunities for individual physicians. For example, 1982 civilian earnings for nonsurgical specialties ranged from less than $30,000 (4 percent of the group) to more than $250,000 (for 5 percent of the group).[26] The range of actual expected civilian earnings for physicians in the sample is likely to include median earnings in a given

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[8]This assumption was supported by statistical results when the two variables were entered separately.

specialty group, but most likely it will misestimate individual physicians' civilian earnings.

Over the period of the analysis, both military and civilian earnings increased, but the ratio of the two, i.e., relative earnings, remained fairly stable despite the new bonus. Table 9 shows the military civilian earnings ratio for surgical and nonsurgical specialists for ,977-1982.

It is assumed that, in general, military practice will not affect physicians' civilian earnings differently than would equal years of civilian practice. As a rule, volunteer physicians do not acquire additional medical training while on active duty. However, because of the initial start-up time for building a civilian private practice, the civilian income of some physicians who leave the military to start private practice may be lower initially than civilian income of nonveteran private practitioners with equal practice experience. Physicians in salaried positions would not be affected.

Observed individual physicians' earnings in the sample varied substantially across several dimensions. Civilian income varied by specialty; military income varied by years of service and military grade, and beginning in FY1981 by board certification and specialty.

In FY1981 military income was substantially lower than civilian earnings opportunities for physicians in the sample. After two years of

Table 9

MILITARY/CIVILIAN EARNINGS RATIO,
GRADE 04, 3 YEARS OF SERVICE,
3-5 YEARS RESIDENCY TRAINING

Fiscal Year	Surgical Specialists	Nonsurgical Specialists
1977	.47	.59
1978	.47	.59
1979	.43	.56
1980	.40	.55
1981	.43	.56
1982	.43	.57

SOURCES: *Medical Economics*, Physicians' Earnings Surveys, 1978-1983; *Uniformed Services Almanac*, 1977-1982.

NOTE: Civilian earnings are median earnings for office-based physicians. Military earnings are basic pay (RMC/BMC) plus applicable bonuses.

service.[3] military earnings ranged from $44,198 to $73,643, with an average income of $52,782. After five years of service, physicians earned between $52,515 and $74,122 (average income was $61,780). Expected median civilian earnings ranged from $75,620 to $117,968. The average expected median civilian earnings were $96,551 after two years of service and $86,988 after five years of service. The lower average median civilian earnings observed after five years of service are attributable to the specialty distribution, which includes more lower earning primary care physicians in the later service year groups (discussed in the next subsection).

Table 10 shows the observed earnings ratios overall, by specialty group and year group. Primary care physicians consistently have a higher earnings ratio than the other groups. Hospital based physicians have the lowest observed earnings ratio for all year groups.

Table 10

EXPECTED MILITARY CIVILIAN EARNINGS RATIOS BY SERVICE YEAR
AND SPECIALTY GROUP FOR VOLUNTEERS IN THE SAMPLE

Service Year Group	All Specialties	Primary Care	General Surgeons Ob gyn	Sub specialties	Hospital based Specialties
0-1	.565	.647	.487	.528	.465
1-2	.58	.775	.44	.447	.404
2-3	.58	.65	.437	.450	.540
3-4	.588	.653	.467	.454	.354
4-5	.627	.759	.532	.477	.437
5-6	.684	.746	.524	.457	.462

SOURCES: *Medical Economics* Physicians Earnings Survey 1979 (adjusted for inflation). *Uniformed Services Almanac* 1977-1982.

Specialty [PRIMSPEC, SPCLTY, HSPBSD]

A physician's specialty not only affects his earnings opportunities, it also influences his practice setting and practice attributes. To cite but two extremes, psychiatry (one of the lower earning specialties – $78,500 median civilian practice earnings) and radiology (one of the

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[3] The years of service refer to the current tour only. Any prior military service or ser vice credits are not included but will be reflected in the physician's military earnings

highest earning specialties—1981 median civilian practice earnings = $127,310) are practiced in very different settings. Those differences in civilian opportunities both with respect to earnings and with respect to practice attributes are likely to affect how a physician will evaluate military practice at the time he joins and how he will reevaluate it at the end of his initial commitment. The military/civilian earnings ratio accounts for the difference in military and civilian earnings opportunities. To capture separately the nonpecuniary aspects of physician specialty and their relationship to retention, a physician specialty variable was included in the model. Practice attributes of physician specialty are designed to capture the unmeasured attributes, which are likely to characterize the practices of the volunteer physicians in the sample and which are not accounted for by their other known characteristics of training and age. These attributes might not necessarily apply to physicians from other procurement programs, for whom training and age may differ.

For all specialty groups, the specialty variable is likely to measure aspects of civilian opportunities not reflected in the military/civilian earnings ratio. As discussed earlier, the civilian earnings measure is not highly specific to the volunteers in the sample, but captures primarily the relative earnings opportunities of the different specialties without regard to individual training, quality, and experience.

Ignoring those physicians who choose military practice only as short-term transitional employment during which to search for better civilian opportunities, it is expected that (given relative earnings) physicians' retention decisions will be related to how well their expectations of military practice match their actual practice experience during their initial term. One reason for choosing a particular specialty is likely to be practice characteristics. If, for example, a physician values continuity of care and a physician/patient relationship, these aspects will probably matter in both civilian and military settings. It is hypothesized that physicians will tend to prefer similar modes of practicing their profession, i.e., the mode most characteristic of their specialty, regardless of whether they choose military or civilian employment. Accordingly, physicians were grouped into four specialty categories based on practice characteristics. The four groups are:

- *Primary care physicians (general and family practice, internal medicine, pediatrics) and psychiatrists (N = 913; three year obligors N = 529)*

In addition to general and family practice, internal medicine and pediatrics were included in the primary care group. This group of

physicians, as well as psychiatrists, are primarily office-based and generally establish a close relationship with their patients over a long period of time. Many of the pediatricians, internists, and subspecialists in the sample of volunteers were not board certified, suggesting that their practice would be more similar to general and family practitioners than to the more highly specialized subspecialists. The military practice characteristics of this group are probably least like those in the civilian sector and, other things equal, they are probably less likely to prefer military practice than the other groups.

- *Surgeons and ob/gyn physicians (N = 197; three-year obligors N = 114)*

Surgeons and obstetricians/gynecologists are more dependent than are primary care physicians on hospital privileges for the major part of their practice. Hospital practice privileges for surgeons are highly dependent on board certification, and surgical subspecialty privileges are dependent on subspecialty boards (e.g., to grant thoracic surgery privileges, most major hospitals would require subspecialty board certification in thoracic surgery rather than simply general surgical boards). For the surgeons in the sample who were board certified, the data do not distinguish between general surgical and subspecialty boards, and also do not indicate how much subspecialty training these physicians completed. For this reason, surgical subspecialists under the Air Force Specialty Code of surgeons were included in the general surgical group. (Surgical subspecialties, as well as medical subspecialties with separate Air Force Specialty Codes, were grouped separately—see discussion of subspecialties.) However, the data show that the majority of surgeons, as well as of the obstetricians in the sample, were assigned to small Air Force hospitals ($\leq$ 50 beds), i.e., they are less likely to be highly specialized. In the civilian sector, these physicians would probably practice in somewhat similar settings (smaller community hospitals). According to the above hypothesis, at a given earnings ratio this group is expected to be more likely to prefer military practice than the primary care group, although less than the hospital-based groups (see discussion below).

- *Surgical and nonsurgical subspecialists (ear, nose, and throat; dermatologists; neurologists; neurosurgeons; opthalmologists; orthopedists; urologists) (N = 82; three-year obligors N = 38)*

Surgical and nonsurgical subspecialists tend to deliver primarily specific subspecialty care on an episodic rather than an ongoing basis, depending, for the most part, on patient referrals from other

physicians. Most of the volunteers in this group were assigned to the larger Air Force regional hospitals and medical centers, indicating a greater likelihood of practicing predominately in their specialty. Because of the similarity in patient care and the opportunities for specialty practice in the military, this group of physicians, other things equal, is expected to prefer the military, compared to the primary care group.

- *Hospital-based physicians (radiologists, anesthesiologists, pathologists) (N = 126; three-year obligors N = 90)*

The practice characteristics of hospital-based physicians are likely to be very similar in both military and civilian practice. On average, this group of volunteers in the sample (mostly FMGs) would not practice in civilian hospitals with technology substantially superior to that which exists in the majority of even the small Air Force facilities where most of them practice. Other things being equal, hospital-based physicians are expected to be retained in the military at a higher rate than are primary care physicians.

Table 11 shows the distribution of physicians in each specialty group by year group (the percentage of physicians with three-year commitments is shown in parentheses). The majority of the primary care physicians in the sample were recruited before 1977, consistent with the Air Force's requirement for primary care physicians, especially GPs and family practitioners, following the end of the draft. Volunteer

Table 11

DISTRIBUTION OF VOLUNTEER PHYSICIANS IN THE SAMPLE
BY SERVICE YEAR GROUP AND SPECIALTY GROUP

| Service Year Group | Total Number of Physicians | Percentage of Physicians by Specialty Group | | | |
		Primary Care	General Surgeons, Ob/gyn	Hospital-based Specialists	Sub-specialists
0-1	1318 (718)	69 (68)	15 (15)	10 (12)	6 (5)
1-2	1206 (687)	71 (70)	14 (13)	9 (12)	6 (5)
2-3	1054 (583)	72 (70)	13 (13)	10 (12)	5 (5)
3-4	722 (451)	73 (72)	12 (12)	10 (11)	5 (5)
4-5	375 (167)	77 (78)	9 (6)	9 (10)	5 (5)
5-6	225 (65)	77 (76)	9 (5)	10 (14)	4 (5)

NOTE: Three-year obligors are in parentheses.

primary care accessions have decreased since 1977, as has the total number of volunteer accessions.

Table 12 shows the average observed continuation rates by specialty group for all physicians in the sample and, in parentheses, for those with three-year commitments. Observed initial retention at the end of the commitment for the three-year obligors was lowest for the general surgical-ob/gyn group (.41) and highest for the hospital-based physicians (.68). (The rate for surgeons was .44 and for ob/gyns .30, a difference which can be explained largely by differences in age, grade, and training.)

Table 12

OBSERVED CONTINUATION RATES FOR VOLUNTEER PHYSICIANS
IN THE SAMPLE BY SERVICE YEAR GROUP AND SPECIALTY GROUP

		Continuation Rates by Specialty Group			
Service Year Group	All MDs	Primary Care	General Surgeons, Ob/gyn	Hospital-based Specialists	Sub-specialists
0-1	.97 (.97)	.97 (.97)	.95 (.93)	.98 (.98)	.97 (.95)
1-2	.95 (.95)	.94 (.94)	.96 (.96)	.99 (.99)	.97 (.96)
2-3	.83 (.95)	.81 (.95)	.84 (.91)	.91 (.97)	.81 (.93)
3-4	.66 (.55)	.65 (.59)	.63 (.48)	.77 (.72)	.69 (.50)
4-5	.86 (.86)	.87 (.86)	.84 (.98)	.91 (1.00)	.78 (.97)
5-6	.94 (.94)	.94 (.92)	.85 (1.00)	1.00 (1.00)	1.00 (1.00)

NOTE: Service year groups are based on different entry year cohorts (see Table 1). Three-year obligors are in parentheses.

Foreign Medical Graduates [FMG]

Of the 1406 volunteers in the sample who entered the Air Force between FY1975 and FY1981, 52 percent were foreign medical graduates. As shown in (Table 9), they were most likely to have three-year commitments. In FY1983, about one-quarter of FMG accessions were not U.S. citizens.[31]

FMGs account for a disproportionately large number of specialist accessions. Sixty percent of the nonprimary care volunteers in the sample were foreign graduates. Table 13 shows the distribution of FMGs in the sample by year group. Although, as stated earlier, fewer

FMGs have been recruited in recent years, the proportion of FMGs has increased.

An analysis of FMGs' practice experience [4] based on 1979 data indicates that foreign graduates as a group earn less than graduates from U.S. medical schools and are practicing in the less desirable locations. Since 1976, when there was not much earnings difference between the two groups, FMGs' earnings have risen more slowly than those of U.S. graduates, indicating perhaps an increasingly unfavorable civilian environment for FMGs. Median earnings in 1979 for office-based FMGs were $64,390 (a 3 percent increase from the 1976 median of $62,310). Median earnings for office-based U.S. graduates were $78,650 (a 25 percent increase from the 1976 median earnings of $62,930). In addition, 31 percent of FMGs earned less than $50,000 in 1979, compared with 21 percent of U.S. graduates. A large part of this difference in earnings seems to be explained by the lower number of patient visits per week for FMGs (12 percent fewer visits) and by the increasingly larger number of FMGs in general practice (39 percent in 1977 vs. 54 percent in 1980) as family practice residencies are increasingly being filled by U.S. graduates. Because FMGs appear to have fewer and poorer civilian opportunities, those who choose military practice are likely to be retained at a higher rate, other things being equal.

Table 13

DISTRIBUTION OF FOREIGN MEDICAL
GRADUATES BY SERVICE YEAR GROUP
AND YEARS OF OBLIGATION
(Percent)

Service Year Group	All Volunteers	Volunteers with 3-Year Obligation
0-1	52	60
1-2	54	60
2-3	55	62
3-4	55	61
4-5	48	53
5-6	46	48

Osteopathic Physicians [OSTEOP]

Approximately 11 percent of accessions in the sample are osteopathic physicians. These osteopaths tend to be older as a group. Half of them were 50 or older when they joined, compared to slightly more than one quarter of all volunteer accessions. Like the FMGs, the osteopaths, almost all of whom are general practitioners, are expected to be retained at a higher rate than allopathic physicians, because osteopaths' civilian opportunities are likely to be inferior. Table 14 shows the distribution of osteopaths in the sample by year group.

Table 14

DISTRIBUTION OF OSTEOPATHIC
PHYSICIANS IN THE SAMPLE
BY SERVICE YEAR GROUP
(Percent)

Service Year Group	All Volunteers	Volunteers with 3-Year Obligation
0-1	11	10
1-2	11	11
2-3	11	10
3-4	12	12
4-5	16	17
5-6	20	25

Board Certification [BOARDS]

Board certification is an overall measure of physician quality. In civilian practice, board certification not only increases physicians' earnings relative to nonboard certified physicians in the same specialty, but it also greatly enhances a physician's practice attributes. Board certified physicians are substantially more likely to obtain admitting privileges in the more prestigious hospitals and to have greater access to alternative practice modes. Many HMOs, for example, will employ only board certified physicians. Thus, physicians who do not qualify for board certification, either because of insufficient training or because they are no longer board eligible, probably have few alternatives to private practice. Only 26 percent of the physicians in the sample were

board certified.[10] Table 15 shows the distribution of board certified physicians in the sample by year group and Table 16 shows their observed continuation rates by year group. The percentage of board certified accessions per year has varied from a low of 16 percent in FY1978 to a high of 31 percent in FY1981 (however, the number of board certified accessions has decreased from 70 in FY1976 to 31 in FY1981).

Based on the prospect of more desirable civilian practice opportunities alone, board certification is expected to be negatively related to retention. However, board certification also enhances physicians' opportunities in military practice. To the extent that the Air Force rewards quality, board certification may well be related to higher retention. First, it is likely that board certified physicians are given, if not a choice of assignment, at least better positions within their assigned facility. Second, one of the provisions of the 1980 Pay Bill was to award a bonus for board certification. A special feature of this bonus

Table 15

DISTRIBUTION OF BOARD CERTIFIED
PHYSICIANS IN THE SAMPLE
BY SERVICE YEAR GROUP
(Percent)

	Board Certified Physicians as a Percent of:	
Service Year Group	All Volunteers	Volunteers with 3-Year Obligation
0-1	9	7
1-2	14	13
2-3	18	20
3-4	23	21
4-5	29	28
5-6	36	40

NOTE: Year groups in the sample are not based on a single cohort; see Table 1.

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[10]Before FY1981, when the bonus to board certified physicians went into effect, it is possible that data on board certification may have been missing from the Uniformed Officer Record (UOR) in some cases for some years. To minimize this possibility, a physician in the sample was assumed to be board certified if he was shown to be board certified for any year in which he was on active duty.

Table 16

OBSERVED CONTINUATION RATES OF BOARD CERTIFIED AND NONBOARD CERTIFIED PHYSICIANS IN THE SAMPLE BY SERVICE YEAR GROUP

Service Year Group	All MDs	MDs with Boards
0-1	.97 (.97)	.98 (.98)
1-2	.94 (.95)	.96 (1.00)
2-3	.82 (.95)	.90 (.97)
3-4	.66 (.56)	.66 (.51)
4-5	.86 (.86)	.93 (.92)
5-6	.94 (.94)	.88 (.85)

NOTE: Year groups in the sample are not based on a single cohort: see Table 1. Three-year obligors in parentheses.

is that it increases directly with years of service, i.e., it is the only bonus which increases beyond 10 years of creditable service (service credits plus actual active duty service), rewarding experience as well as board certification.[11]

Another way to reward higher quality physicians is through a higher grade. Although board certified physicians in the sample appeared to have higher grades as a group than nonboard certified physicians, this difference was not significant when specialty was taken into account. In general, specialists would have higher grades. Specialists with longer residencies have higher grades than those with shorter residencies, as grade is related to the number of years spent in training.

Military Grade [GR4, GR5, GR6]

Military physicians' entry grade is determined by the number of years spent in training and on their practice experience. Years of training include medical school, internship, and residency. Experience includes any military service, prior public health service, or civilian practice. Currently one-half year of credit is given for each year of private practice up to a maximum of three years of credit. (However, in earlier years somewhat more credit was given for experience and for

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[11]The amount of the experience-increase in the board certified bonus just offsets the decrease in variable special pay due to experience.

practicing in a shortage specialty.) Volunteers with up to 9 years of total credit enter as captains (03), those with 9 to 14 years enter as majors (04), and those with 15 years and above enter as lieutenant colonels (05).

Military grade not only determines the basic income of military physicians, it also to a large extent determines their status in the military environment. In addition, there may be a positive relationship between more desirable military assignments/positions, and grade. Certainly, in civilian life physicians are accorded a high measure of status and their environment is extremely structured. The notion of equality, let alone inferiority, of rank with, for example, a charge nurse probably has no counterpart in the civilian environment. If status is as important to physicians as some previous studies indicate,[28, 29] the effect of grade on retention is likely to be positive throughout all year groups, even after controlling for physician income. Table 17 shows the distribution of volunteers 03 through 06 by service year group.

As stated previously, physicians with more years of training will, generally, enter active duty in a relatively higher grade or, if not a higher grade, at least at a higher number of years in grade (less time to promotion). Thus, grade in a given service year group depends on entry grade and promotion. A physician's grade (given training and years of service), like his age, indicates at what stage in his career he entered the service. For example, a general practitioner entering as a lieutenant colonel (05) is likely to be an older physician with many

Table 17

DISTRIBUTION OF PHYSICIANS IN THE SAMPLE
IN GRADES 03-06 BY YEAR GROUP
(Percent)

Service Year Group	03	04	05	06
0-1	32 (37)	38 (38)	28 (23)	2 (1)
1-2	25 (28)	42 (45)	31 (26)	2 (1)
2-3	17 (19)	47 (52)	32 (27)	4 (2)
3-4	9 (10)	48 (56)	32 (28)	11 (6)
4-5	3 (03)	32 (44)	37 (34)	28 (19)
5-6	0 (0)	12 (14)	50 (55)	38 (31)

NOTE: Year groups in sample are not based on a single entry year cohort; s.e Table 1. Three-year obligors are in parentheses.

years of civilian practice and/or prior service—a young GP fresh out of training is likely to enter as a captain (03). Thus, a positive grade coefficient may simply indicate different tastes for military practice at certain career points, based on a comparison of military and civilian opportunities which are likely to vary over the physician's career.

Table 18 shows the observed year group 3-4 continuation rate by grade for all physicians in the sample. Retention appears to increase with grade.

Table 18

OBSERVED CONTINUATION RATE FOR
VOLUNTEERS IN THE SAMPLE BY
GRADE (SERVICE YEAR GROUP 3-4)

Grade	Number in Grade	Continuation Rate
0-3	62	.40
0-4	348	.60
0-5	234	.73
0-6	78	.91

Assignment [CITF]

Just as physicians in civilian practice seem to prefer certain practice locations and types of facilities over others, military physicians may not be indifferent about their assignments. Although there are probably some general attributes of assignments which are preferred (e.g., a "higher quality" facility and adequate support staff), assignment preferences are likely to be highly subjective. Data on individual assignment preferences that would allow a comparison between the preferred and actual assignment were not available.

A group of assignment variables was entered to determine the effect of assignment, specifically hospital size, on the retention of volunteers. Although observed retention for the volunteers in the sample was lowest for small Air Force hospitals, it was not significantly different for smaller hospitals in a model including physician specialty. Retention was also not affected by assignment to a regional hospital or medical center, both indicating a progressively wider range of cases and greater diversity in the medical staff in addition to their generally larger size (some primary care hospitals with 100 beds are as large as some regional hospitals). In addition to hospital assignment, indicators

for urban and rural locations were tried in the model but were not significant.

Volunteers with overseas assignments had a significantly higher retention rate (65 percent) than those with U.S. assignments. Table 19 shows the sample distribution of all physicians and of those with three-year commitments who had foreign assignments, by service year group.

Because foreign assignments carry a firm commitment to serve for at least three years in one location, the relationship between retention and foreign assignments for year groups 2-3 and 3-4 is not surprising. However, this does not account for year groups 4-5 and 5-6. Why do physicians on foreign assignments have a higher probability of remaining in the Air Force?

One factor may be the expectation of less frequent moves, although overall the physicians in our sample did not appear to change assignments frequently.[12] Another possibility suggested by the higher observed retention for service years 4 and 5 might be a tendency for career Air Force physicians to choose voluntarily a transfer to a three-year foreign assignment during their initial period of commitment in return for an assignment of their choice on a subsequent tour.

Table 19

SAMPLE DISTRIBUTION OF PHYSICIANS
ON FOREIGN ASSIGNMENT BY
SERVICE YEAR GROUP
(Percent)

Service Year Group	MDs on Foreign Assignments as a Percent of:	
	All Volunteers	3-Year Obligors
0-1	17	19
1-2	17	19
2-3	21	20
3-4	25	22
4-5	29	29
5-6	30	31

NOTE: Year groups in the sample are not based on a single cohort; see Table 1.

[12] It is not known from the data whether physicians who left were about to be reassigned.

To better understand how assignment and retention might be related, it would be important to know more about Air Force assignment policy and about the future assignments of this group of physicians. If foreign assignments are voluntary, i.e., requested by the individual, a positive effect on retention would not be surprising. However, because this information is available only for those physicians who stayed, it cannot be analyzed in the context of this study. It may be worthwhile to learn more about the Air Force's assignment policy and its effect on volunteer retention.

Sex, Race, Marital Status

The sample of volunteers included 17 percent females and 83 percent males. Observed retention appears to be independent of sex. In addition, for both females and males separately, observed retention appeared to be independent of FMG/U.S. graduate status. See Table 20 for observed retention rates by sex and FMG/U.S. graduate status. Sex was omitted from the model. Two other demographic variables, race and marital status, were also insignificant.

Table 20

OBSERVED INITIAL RETENTION FOR
VOLUNTEERS BY SEX AND FMG/U.S.
GRADUATE STATUS

Status	Male	Female
U.S. graduate	.46	.44
FMG	.44	.38

Age [SQRTAGE]

Volunteer physicians enter military practice at different stages in their careers. Some enter immediately following their training, but the majority join after some civilian practice experience. The age range of these accessions varies widely from below 30 to 58. Volunteers at different stages in their careers are likely to have joined the service for different reasons and with different goals and expectations as well as different civilian opportunities. These are likely to affect retention behavior.

The physician's age is an indicator of experience and, as such, is related to the grade (and thus earnings) in which volunteer physicians enter military service, i.e., older physicians are likely to enter in a higher grade than are younger physicians. Thus, in a model not controlled for income or grade, retention would be expected to increase with age until physicians reach retirement age.

The mandatory retirement age for Air Force physicians is 60 in most cases. Civilian physicians seldom retire at age 60. Most likely, as they approach retirement age, military physicians, especially volunteers, many of whom do not qualify for retirement benefits, will begin to search for civilian opportunities. The time frame of such a search probably varies a great deal, possibly between ages 55 and 60. Many of these physicians might not have left military practice except for the retirement rule, i.e., their retention decision might not have been their choice.

To qualify for retirement benefits, military physicians must have completed 20 years of service. The mandatory retirement age is 60 in most cases. To determine whether physicians who were young enough at entry to qualify for retirement benefits might be retained at a higher rate, an indicator for retirement eligibility was tried in the model. It was not significant for physicians in the sample. It is possible that this insignificant result is due to incomplete data. The variable was excluded from the analysis.

The majority of volunteers in the sample were between 35 and 55 years of age. Table 21 shows the average age of volunteers by service year group. Table 22 shows the age distribution of volunteers in the sample in the final year of their commitment. FMGs tended to be younger than U.S. graduates. More than three-quarters of the FMGs were 45 years of age and below accounting for 65 percent of volunteers under age 45 in the sample), whereas only half the U.S. graduates in the sample were 45 or younger.

Initial retention for U.S. graduates is highest for ages 41 through 55. FMGs, on the other hand, have the highest observed retention rate at age 30 and below (see Table 23). Many of them may have been recent arrivals when they joined, with few alternatives in the civilian sector. The higher observed retention rate of FMGs above age 55 may again reflect fewer civilian opportunities for this group.

This ends the discussion of variables in the model of volunteer physician retention behavior. Next, the empirical results will be discussed and related to policy implications for Air Force retention and procurement strategies.

Table 21

AVERAGE AGE OF VOLUNTEERS IN THE SAMPLE
BY SERVICE YEAR GROUP

Service Year Group	All MDs		2-Year Obligors	
	Mean Age	Std Dev	Mean Age	Std Dev
0-1	40.2	8.5	39.8	8.85
	41.0	8.4		8.24
	41.2	8.4	41.4	8.0
3		8.1		8.0
		8.8	41.7	
	41.9	8.0	9.1	

Table 22

DISTRIBUTION OF FMG-U.S. GRADUATE VOLUNTEERS
IN THE SAMPLE BY AGE GROUP
(Percent)

Volunteers									All
FMGs									100
U.S. Graduates									100
All									100

NOTE: Ages as of the final year of commitment.

Table 23

OBSERVED INITIAL RETENTION BY
AGE AND FMG-U.S. GRADUATE
STATUS FOR VOLUNTEER
PHYSICIANS IN THE SAMPLE

Age Group	FMG	U.S. Graduate
		100
	4.3	4.7
		4.8
	.80	
	.00	.90
N		.00

NOTE: Ages as of the final year of
commitment. Commitment dates from
two to four years.

EMPIRICAL RESULTS

Tables 24 and 25 show the results of estimating the logistic equation (described earlier in this section) for the retention behavior of Air Force volunteer physicians. The coefficients in the tables were estimated directly from the set of explanatory variables using maximum likelihood techniques (see earlier discussion). Maximum likelihood estimation provides estimates which are asymptotically efficient and normally distributed. McFadden notes that the approximation is reasonably good even in quite small samples [22, p. 119].

The most important year group is 3-4, when physicians with three-year commitments are facing the initial retention decision. Throughout the discussion below, the results for this year group will be emphasized.

Table 24

MAXIMUM LIKELIHOOD COEFFICIENT ESTIMATES AND
t-RATIOS FOR THE CONDITIONAL RETENTION
MODEL OF VOLUNTEER PHYSICIANS
WITH THREE YEAR COMMITMENTS

Service Year Group

Variable	3-4 N = 444 (X^2 = 41.07)		4-5 N = 167 (X^2 = 13.21)	
LFINCR	.586	(2.28)	.894	(2.0)
PRIMSPEC	.905	(.81)	.366	(.55)
HSPBSD	1.527	(3.68)	6.293	(.66)
SPECLTY	.736	(2.23)	1.359	(1.28)
CILF	.369	(2.97)	.627	(1.17)
ENIG	.247	(.97)	.699	(1.29)
OSTEOP	.457	(1.13)	.394	(1.39)
SQRTAGE	.928	(.11)	.286	(.18)
BOARDS	.056	(1.48)	.747	(1.29)
GR4	.222	(2.13)	1.005	(.48)
GR5	1.043	(2.16)	.511	(.8)
GR6	2.002	(2.75)	.672	(.42)
CONSTANT	.003	(.005)	1.573	(.8)

t-ratios are in parentheses.
Significant at the 99 percent level.

Table 25

MAXIMUM LIKELIHOOD COEFFICIENT ESTIMATES AND
t-RATIOS[a] FOR THE CONDITIONAL RETENTION
MODEL OF VOLUNTEER PHYSICIANS

	Service Year Group			
Variable	2-3 $\left(\begin{array}{l}N = 1007 \\ X^2 = 226^b\end{array}\right)$	3-4 $\left(\begin{array}{l}N = 707 \\ X^2 = 142.60^b\end{array}\right)$	4-5 $\left(\begin{array}{l}N = 373 \\ X^2 = 42.03^b\end{array}\right)$	5-6 $\left(\begin{array}{l}N = 224 \\ X^2 = 34.57^c\end{array}\right)$
C1	-2.307 (- 7.41)	.602 (1.58)	1.632 (1.53)	.185 (.18)
C2	-2.385 (-10.08)	1.244 (4.75)	- .258 (- .65)	.014 (.02)
C4	.949 (.10)	3.127 (4.39)	- .396 (1.77)	.036 (.06)
LEINCR	- .687 (- .82)	1.478 (2.10)	.548 (3.97)	- .613 (- .22)
PRIMSPEC	- .318 (- .88)	.234 (.68)	- .288 (- .39)	-2.252 (-1.55)
HSPBSD	.176 (.32)	1.274 (3.06)	.358 (.41)	6.352 (.62)
SPCLTY	- .283 (.51)	.457 (.95)	- .893 (-1.14)	5.602 (.24)
CITF	1.192 (4.11)	.625 (2.85)	1.318 (2.77)	2.44 (1.80)
FMG	.670 (2.92)	.523 (2.35)	1.320 (2.91)	.593 (.60)
OSTEOP	.584 (1.96)	.504 (1.51)	1.254 (2.24)	1.136 (.96)
SQRTAGE	- .148 (- .62)	- .155 (- .71)	- .255 (- .57)	-3.499 (-2.99)
BOARDS	.326 (1.09)	- .213 (- .98)	1.035 (2.37)	-2.375 (-2.94)
GR4	.453 (1.54)	.798 (2.47)	1.477 (1.95)	
GR5	.978 (2.27)	1.277 (3.05)	2.383 (2.57)	3.813 (2.84)
GR6	2.405 (2.99)	2.582 (3.91)	2.775 (2.50)	6.304 (3.19)
CONSTANT	2.097 (1.44)	.463 (.34)	.627 (.23)	.233 (3.12)

[a]t-ratios are in parentheses.
[b]Significant at the 99 percent level.
[c]Significant at the 95 percent level.

The results of earlier year groups are somewhat misleading (and nonsignificant for the three-year obligors) primarily because committed physicians do not really make a retention decision during their commitment. However, about 18 percent of the volunteers in the sample left active duty before the end of their commitment, as discussed earlier.

In the later year groups, the number of observations in many cells is often too small and little variance remains in the data as physicians pass the end of their commitment and remain in the career force at an increasing rate (observed overall retention was .86 for year group 4-5 and .94 for year group 5-6).

Overall, the empirical results are as expected, i.e., the coefficients have the expected signs.

Military/Civilian Earnings Ratio

Increased retention probabilities for volunteer physicians appear to be associated with higher military and civilian earnings ratios. The overall degree of responsiveness can be measured by the elasticity of retention with respect to the earnings ratio (defined as the percentage change in retention with respect to a 1 percent change in earnings).

The average elasticity of retention for volunteer physicians with three-year commitments is .84 (standard error = .37), implying a .84 percent increase in retention in response to a 1 percent increase in the earnings ratio at an already high retention rate of .55 and an average earnings ratio of .58. Put another way, a 1 percent increase in the earnings ratio would increase the retention probability from .550 to .555.[13]

In a 1975 internal Rand study Albright and Chu found the elasticity of retention for Berry Plan physicians (based on data from 1964–1969) to be 3.8 at an average retention probability of .034 and an earnings ratio of .75.

Such a large difference in the retention elasticities suggests, as one would expect, that the draft-motivated Berry Planners and the post-draft volunteers in the sample come from different populations, i.e., their retention supply functions are different.

Figure 1 shows the initial retention supply curves for Berry Planners and those for the volunteers estimated in this study (a more detailed discussion of volunteer retention supply curves follows in Sec. IV). The curves show the proportion of physicians expected to be retained beyond their commitment at different military and civilian earnings ratios. It was noted above that the responsiveness of Berry Planners and volunteers to changes in the earnings ratio differs substantially. The differences in the height of the retention supply curves indicate that the expected retention probabilities of all groups of volunteer physicians are markedly higher at all earnings ratios than the estimated retention probabilities for the Berry Planners. This result is consistent with the conclusions of the 1970 President's Commission on an All-Volunteer Armed Force [5] which anticipated significantly higher retention for volunteers than for draft motivated military personnel. Berry Planners merely chose to postpone their mandatory military service, they did not voluntarily choose military employment (however short). In terms of implications for Air Force procurement policy, Berry Planners' retention behavior might more closely resemble the

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[13]Based on an elasticity of .84 and a standard error of .37, retention would increase by .84 percent ± .72 percent, implying a change in retention from .55 to between .551 and .559 with 95 percent confidence.

Fig. 1—Initial retention supply curves for Berry Plan
physicians* and volunteer physicians
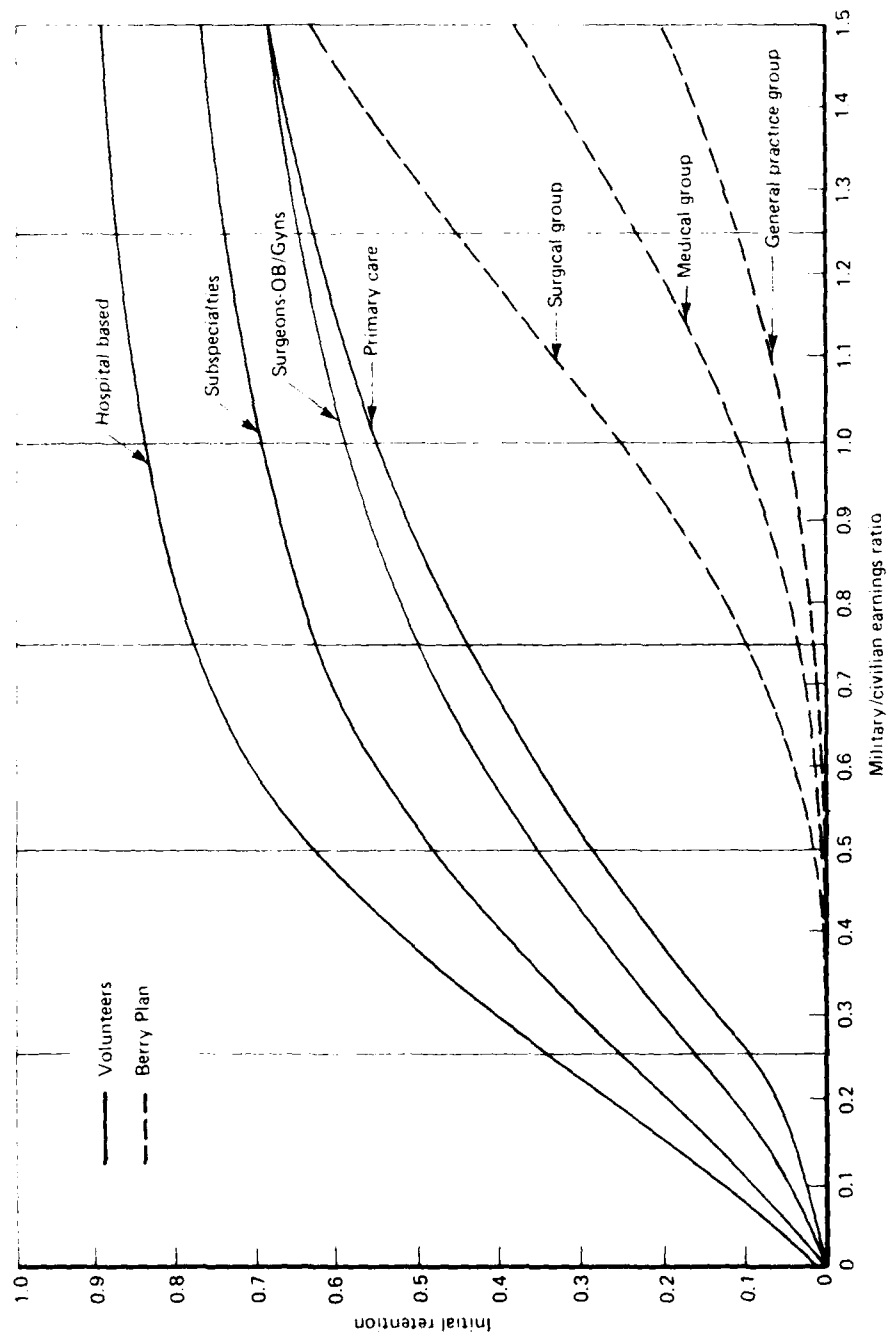
*SOURCE W H Albright and D S C Chu, The Rand Corporation

retention behavior of the AFHPSP physicians. Some among this group chose military service simply to finance their education.

The empirically estimated responsiveness of the volunteer physicians to changes in the earnings ratio implies that a decrease in earnings would reduce the retention probabilities almost proportionately. With the current pay structure (no inflation protection for special pay) and the limited increase in regular military compensation, the expected military/civilian earnings ratio for physicians is likely to decline in the future, especially if civilian physicians' earnings continue to keep pace with inflation (and are not substantially affected by an increasing physician supply). Physician special pay, accounting for up to one-half of total earnings, has already declined in real terms since its levels were set in 1980.[14] Protecting special pay against inflation would prevent a further erosion of the earnings ratio.

The effect of the earnings ratio on the retention probabilities of volunteers has other important implications for policy. As shown earlier, the earnings ratios of the volunteer physicians in the sample vary by more than one-third across specialty (see Table 10). To increase the retention of shortage specialties, future pay raises might be targeted to shortage specialties in the form of a bonus rather than through real increases in basic pay to all physicians, a far more expensive option.

Specialty

At a given earnings ratio, there was no significant difference between primary care physicians and the surgeons and obstetricians. Hospital-based specialists have significantly higher retention probabilities according to the model. Slightly higher initial retention for volunteer specialists is consistent with the Albright and Chu findings for Berry Planners. However, the interpretations of these findings and their implications for Air Force physician procurement are clearly not the same. The current volunteer physicians are not perfect substitutes for physicians from other past or current procurement programs, e.g., the Berry Plan or the AFHPSP. Current volunteer physicians are a quite heterogeneous group with respect to age, training, and quality. Many of the physicians who are retained beyond their commitment are older and, in addition, may not provide the level of quality and career potential the Air Force is seeking. The unexpectedly large positive

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[14]With a CPI rise of 11.7 percent, 7.5 percent, and 3.9 percent for 1981, 1982, and 1983, respectively, a $20,000 bonus would have decreased in real terms to roughly $16,000.

coefficient for hospital-based volunteers can probably not be explained by the similarity in practice attributes alone; it may be related to the kind of hospital-based specialists the Air Force attracts and the types of civilian alternatives open to them in an increasingly competitive market.

FMGs and Osteopaths

As expected, the positive coefficients for foreign medical graduates and osteopaths indicate higher retention probabilities for these groups than for U.S. graduates. This is consistent with the hypothesis that FMGs' civilian opportunities are likely to be poorer and that they will remain in military practice not solely because of preference, but because their civilian practice opportunities are likely to be demand constrained.

Foreign medical graduate volunteers as a group are younger than U.S. graduate volunteers. Seventy-eight percent of FMGs are under 45 years of age (only 50 percent of U.S. medical graduates are). These younger physicians in particular may remain in military practice for a number of years to improve their civilian opportunities, instead of entering civilian practice immediately upon obtaining U.S. licenses. Such an experience effect of military practice on FMGs may explain why after five years of service FMGs behave more like U.S. graduates who are, by then, careerists (i.e., the FMG coefficient becomes nonsignificant).

For physicians with three-year commitments, the probability of being retained past their commitment is not significantly different for FMGs than for U.S. graduates, again controlling for specialty. However, those FMGs who are retained beyond their commitment tend to remain longer than U.S. graduates.

The three-year obligor group has the highest proportion of FMGs. Over 70 percent of them are practicing in a specialty, as opposed to 58 percent of U.S. graduates. The importance of this result for Air Force physician procurement is perhaps less that FMGs appear more likely to be retained longer than U.S. graduates, than that the vast majority of specialists who are retained are FMGs because (1) the Air Force does not attract many U.S. graduate specialists in the first place and (2) it keeps fewer of them than of FMG specialists. As discussed before, the Air Force has recently recruited fewer FMGs. However, a desire to decrease the ratio of FMGs to U.S. graduates does not, under current supply conditions, appear compatible with a policy of expanding the role of volunteer recruiting.

Retaining osteopaths, most of whom are older and were recruited in the early years of the volunteer procurement program when the shor-

tage of general practitioners was most severe, has perhaps few implications for future physician procurement because the Air Force no longer needs to rely on osteopaths to fill its primary care billets.

Age

The age effect on retention was significant only for year group 5-6 in the model which included all volunteers in the sample. This finding is compatible with the notion that physicians will search for alternative employment as they near retirement age.

Military Grade

The military grade coefficients are positive and significant for all year groups examined. This result may support the assertion that status within one's peer group may be an important factor in the continuation decision. Alternatively, it may indicate that, given training and years of military service, physicians who join at a later career stage are more likely to be retained than the more recent graduates.

As discussed earlier, the grade variable in the model reflects the physician's military grade in the year he makes the retention decision. It depends on the physician's entry grade, reflecting the individual's experience or career stage, and on promotion. To the extent that higher military grades reflect the Air Force's evaluation of a physician as high quality, it appears that high quality physicians tend to be retained at a higher rate than those considered of lower quality by the Air Force. However if grade is a function of years of service credits or of a temporary shortage in a given specialty (e.g., GPs in the early years), irrespective of an objective quality measure, the positive grade coefficient may simply indicate that the Air Force has been retaining somewhat older physicians who entered with more civilian experience and hence a higher grade.

Because grade is one of the determinants of military earnings, including both variables in the model could produce problems of multicollinearity and misleading coefficients on the two variables. However, omitting the three grade variables from the model did not affect the income ratio coefficient or its t-ratio.[15] When grade was entered into a stepwise regression on the residuals of a regression of the earnings ratio and specialty groups on retention, its coefficient was positive and significant as well.

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[15]When grade was omitted from the regression, the value of the X^2 statistic increased by 10. This indicates that the group of grade indicators was significant at the 95 percent level.

Board Certification

The effect of board certification on retention varied by year group. Within a given military grade group, board certified physicians seemed to be retained at a lower rate than those who were not certified. However, once past the initial retention point, they were more likely to stay, relative to physicians without boards.

IV. INITIAL AND LONG-RUN RETENTION
OF VOLUNTEER PHYSICIANS

The empirical results discussed above indicate that, other things equal, volunteer physicians' retention behavior is responsive to changes in the relative military and civilian earnings, i.e., higher military earnings imply higher retention of volunteer physicians. This section predicts initial and long-run retention for the FY1980 to FY1982 volunteer physician accessions, based on the estimated retention functions, and considers the implications for the Air Force's procurement strategy. The section first describes how the behavioral model of retention was used to predict the retention probabilities.

PREDICTING RETENTION OF FY1980–FY1982 VOLUNTEER ACCESSIONS

If the personal characteristics of a given cohort of volunteer physicians as well as the relevant attributes of their practice alternatives are known, the coefficients of the empirical model can be used to estimate the cohort's retention probabilities. Predicting retention of a given cohort using the retention model assumes that future volunteer accessions will behave like the volunteers in the sample.

Retention rates for each of the first ten years of service were predicted for the 134 volunteer accessions with three-year obligations who entered the Air Force between FY1980 and FY1982. Three-year obligors were selected because they account for the largest proportion of accessions and are probably most representative of the types of volunteer physicians the Air Force is likely to attract in the future.

First, the conditional retention probabilities were obtained for each individual physician in the cohort for year groups 3 4 and 4 5, based on his personal and practice attributes, by fitting the estimated year group coefficients and summing them over all variables. Next, to obtain the unconditional retention probabilities for year $t + 1$, the product of the conditional rates retention probabilities was taken.[1] The

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[1] The conditional retention rates used for year groups 0 1, 1 2, 2 3, and 5 6 were the observed sample rates by specialty. For year groups 6 7 through 9 10, the average conditional retention rates for FY1981 volunteer physician accessions estimated by the Air Force were used. These average rates are based on draft era career physicians. See Ref 30.

unconditional retention probabilities obtained by this method were then summed over all observations in a given group in the cohort (e.g., all surgeons) and divided by the number of observations to obtain the group specific average retention probability. An additional step in the prediction process was to derive uncertainty estimates for the predicted retention probabilities. Uncertainty in the predictions arises from random response error and from the variance in the individual estimated probabilities. An approximate standard error of .05 was calculated under simplifying assumptions.[2]

To predict retention and estimate initial retention supply functions, the FY1980-FY1982 accessions were treated as a single cohort. Except for the individual physician's grade and earnings ratio (which are discussed below) and, of course, age, the service characteristics were held constant throughout the prediction period, i.e., physicians did not change specialties, board certification status, or U.S./foreign assignment.

Grade

The physician's grade in subsequent years was based on his entry grade and the following rule:

Physicians who entered as captains (Grade 03) were given two years in grade and were promoted to major (Grade 04) after four years. Physicians who entered as majors were given one year in grade and were promoted to lieutenant colonel (Grade 05) after four years. Physicians who entered as lieutenant colonels were given zero years in grade and were promoted after six years to colonel (Grade 06). According to this rule, physicians were not promoted until one year after the completion of the initial obligation, at the earliest.

Military/Civilian Earnings Ratio

The military/civilian earnings ratio values used to predict retention are based on the 1983 military and civilian earnings data. Table 26 shows the average 1983 military and civilian earnings for physicians in their fourth year of service. Military earnings data are derived from the 1983 Basic Military Compensation tables and applicable bonuses based on creditable years of service, board certification, and shortage

[2] It was assumed that the fraction remaining after six years (the last year in which sample retention rates were observed) was a binomial random variable, $N = 135$, $p = .32$. This assumption alone would suggest a standard error of square root $(.32 \times .68/134) =$ because p was only estimated and varies from person to person.

Table 26

AVERAGE 1983 EARNINGS FOR PHYSICIANS IN THEIR
FOURTH YEAR OF SERVICE BY SPECIALTY
(Dollars)

Specialty Group	Military	Civilian	Earnings Ratio
Primary care	48,550	79,072	.61
Surgeons	55,681	113,634	.49
Subspecialists	57,066	118,887	.48
Hospital-based	51,167	121,826	.42

specialty. Physicians in the surgical specialties and subspecialties who were eligible for the shortage specialty bonus when they joined continued to receive the bonus throughout.

Civilian earnings data are the 1982 median physician earnings for 13 specialty groups adjusted for inflation (see discussion on civilian physician earnings in Sec. III). It is assumed that the relationship between military and civilian earnings will continue to remain stable over the prediction period and that changes in an individual's earnings ratio will be due to changes in his military earnings. This approach neglects the erosion of the special pay component of military earnings over time because of inflation and overestimates the earnings ratio proportional to the inflation effect.

Cohort Characteristics

Table 27 shows the specialty, age, and grade distribution of the cohort of FY1980-FY1982 volunteer accessions with three-year commitments.

Forty-three percent of the sample entered the Air Force as captains (03), 28 percent as majors (04), and 29 percent as lieutenant colonels (05). When they joined, 35 percent were 35 years of age or below, 38 percent were between 36 and 49, and 27 percent were 50 or older.

Forty-seven percent of the sample were foreign medical graduates. Table 28 shows medical education status by specialty group. About 30 percent of the physicians in the cohort were board certified.

Having briefly described the prediction process and the cohort for which the retention probabilities were predicted, the discussion now turns to the predicted retention rates and their policy implications. After considering the initial retention supply functions implied by the

Table 27

NUMBER OF FY1980–FY1982 VOLUNTEER ACCESSIONS WITH THREE-YEAR
COMMITMENTS BY SPECIALTY, GRADE, AND AGE

		Grade O3			Grade O4			Grade O5		
					Age					
Specialty Group	All	<35	36-49	50+	<35	36-49	50+	<35	36-49	50+
Hospital-based	17	5	5				2		1	2
Subspecialists	16	1	0	0	0	4	0	0	2	
Surgeons/ob-gyn	38	7	4	0	3	4	2	0		10
Primary care/psychiatrists	69	30	8	0	2	6	7	0	6	12
All	134	41	17	0	5	22	11	0	12	27

Table 28

FY1980–FY1981 VOLUNTEER ACCESSIONS (THREE-YEAR COMMITMENT)
BY SPECIALTY AND U.S./FOREIGN GRADUATE STATUS

Specialty Group	Percent Foreign Graduates	Percent U.S. Graduates	All
Hospital-based	82	18	100
Subspecialists	50	50	100
Surgeons/ob-gyn	56	44	100
Primary care/psychiatrists	32	68	100
All	47	53	100

retention model, the effects of an increase in military earnings on the
different groups of physicians in the cohort are discussed.

INITIAL VOLUNTEER RETENTION SUPPLY

Overall, the results indicate that volunteer physicians are retained at
substantially higher levels than either the physicians procured in the

past ... and the Berry Plan ... commitments that age the scholarship of
...

The predicted retention rate one year beyond initial commitment for volunteers with three year commitments is between 28 and 48 percent.[3] The overall rate of 48 percent estimated for the Air Force is at the upper end of this interval.

Hospital based physicians are predicted to be retained at about twice the rate of primary care physicians and about three and one and one third times the rate of subspecialists.

Based on the model of retention behavior of volunteers with three year commitments, initial retention supply functions were derived for different groups of FY1980 FY1982 volunteer accessions. Figure 2 shows the predicted retention supply functions for primary care physicians, surgeons obstetricians, subspecialists, and hospital based physicians. Figure 3 shows retention supply for U.S. and foreign graduates.

The vertical difference between the curves at a given earnings ratio represents the relative influence of the nonmonetary factors in the retention decision. For example, if military earnings were one half of median civilian earnings (an earnings ratio of .50), the proportions of primary care, surgical obstetrical, subspecialty, and hospital-based physicians retained one year beyond their initial obligation are predicted to be around .28, .34, .48, and .64, respectively. Clearly, the results seem to indicate that primary care physicians are least likely to prefer military practice. Hospital-based physicians are over twice as likely to remain in the service as the primary care group, assuming an earnings ratio of .50.

The horizontal distance to the curves shows the earnings ratios required to reach a given level of retention. The supply functions suggest that a 50 percent retention rate for all specialty groups would require military earnings equal to levels of .85, .75, .54, and .36 of median civilian earnings, respectively. To raise the retention of, for example, the surgical obstetrical group from the current level of .39 to .50, an increase in the earnings ratio from .49 to .75 would be required. Increasing the earnings ratio of this group to .75 would mean a military pay increase of roughly $30,000. Subspecialists would require a military pay increase from .48 to .54 of median civilian earnings (about $71,000) to increase their retention from .48 to .50. Physicians in these two specialty groups are the most difficult to replace if they choose to

The Air Force reports that only 4 percent of Berry Planners and 6 percent of deferred scholarship recipients remained one year beyond the initial obligation. See Ref. ...

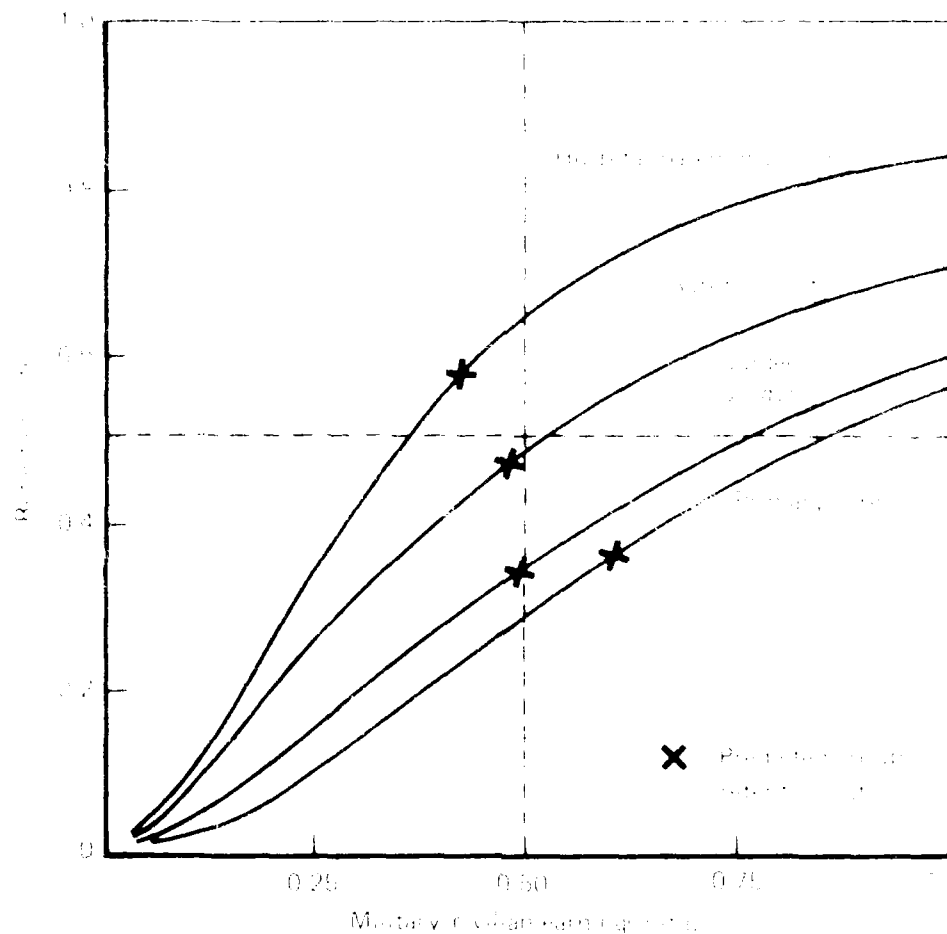This estimate represents a 48 percent ... of Air Force predicted retention rate of ...

Fig 2 Predicted retention supply one year after initial obligation by specialty

leave military service. The responsiveness of retention to higher military earnings for these groups indicates that by increasing pay the Air Force could improve their ability to retain these physicians.

Predicted retention increased with the physician's grade when training and years of service are controlled for. Volunteers who entered the Air Force as captains (04) were predicted to be retained at a significantly lower rate than those who entered as majors or lieutenant colonels. This difference remains even when controlling for the difference in the earnings ratio. Table 29 shows the average predicted annual retention of volunteers in Grades 04 and 04 at an earnings ratio of 1.0 and at their actual observed earnings ratio.
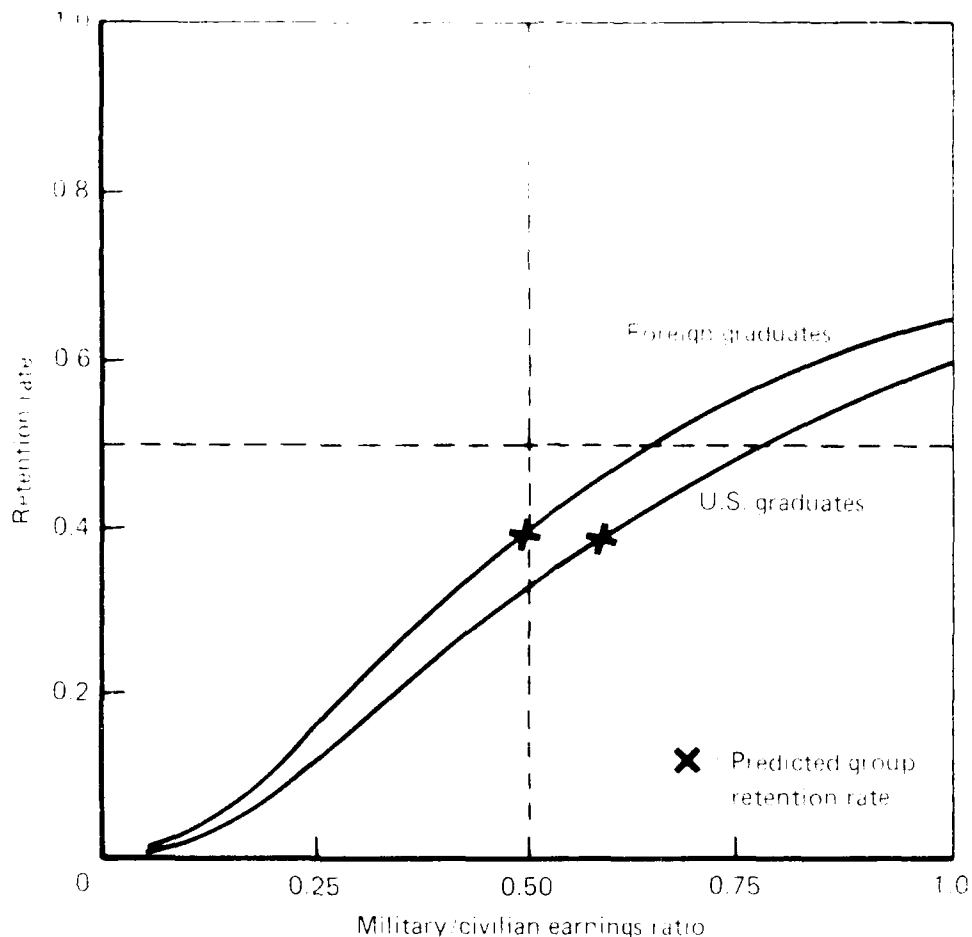
Fig. 3 - Predicted retention supply one year after initial
obligation for U.S. and foreign graduates

Although most subspecialists are entering the Air Force as majors
because of their longer residency training, many young
surgeons/obstetricians enter the Air Force as captains. These young
physicians are probably most like the deferred AFHPSP graduates who
enter military practice immediately following residency training.
Under the prevailing conditions, few of them will remain in the service.
In addition, fewer foreign trained surgeons/obstetricians and subspe-
cialists will be retained. These physicians also tend to be younger and
board certified, in contrast to the hospital-based group.

Predicted retention of all primary care physicians in Grade 04
(including psychiatrists) is roughly .44, about 20 percent above the rate

Table 29

PREDICTED INITIAL RETENTION OF FY1980-FY1982
VOLUNTEER PHYSICIANS BY GRADE, SPECIALTY
AND FMG/U.S. GRADUATE STATUS

Physicians entering as

Specialty Group	Captains (O3)	Majors (O4)	
		FMG	USMG
Hospital based	.54 (.44)	.76 (.71)	.69 (.64)
Subspecialists	.28 (.21)	.47 (.43)	.50 (.49)
Surgeons ob-gyn	.22 (.18)	.45 (.35)	.40 (.41)
Primary care psych	.25 (.28)	.38 (.43)	.34 (.44)

NOTE: Retention at earnings ratio = .50. Retention at actual earnings ratio for specialty group is in parentheses.
ªFMGs only
ᵇU.S. graduates only.

for all surgeons obstetricians in Grade 04. This difference appears to be attributable to the difference in the earnings ratio (i.e., civilian opportunities) between the two groups. At an earnings ratio of .50 (the observed average earnings ratio for surgeons and obstetricians in Grade 04), the retention of all primary care physicians drops to around .37 percent, the same rate predicted for Grade 04 surgeons/obstetricians.

EFFECT OF INCREASING SPECIAL PAY

To address the policy question of how retention of different groups of military physicians is influenced by their relative military earnings, this subsection will examine the initial and long-term effects of raising special pay levels by a flat amount of $10,000 beginning in the fourth year of service. In addition, the costs associated with higher special pay levels and some aspects of physician quality will be considered.

Initial Retention

Table 30 shows the earning ratios resulting from the current special pay level and from a $10,000 increase in special pay as well as the corresponding retention probabilities. Table 31 shows how the retention effect of a $10,000 increase in special pay varies with the physician's grade in the final year of his commitment.

Table 30

EARNINGS RATIOS AND PREDICTED INITIAL RETENTION RATES OF FY1980–FY1982 VOLUNTEER ACCESSIONS BY SPECIALTY GROUP AT TWO BONUS LEVELS

Specialty Group	Current Pay		Current Pay + $10,000	
	Earnings Ratio	Initial Retention	Earnings Ratio	Initial Retention
Hospital-based	.423	.566	.506	.634
Subspecialists	.476	.457	.560	.516
Surgeons/ob-gyn	.485	.329	.573	.385
Primary care/psychiatrists	.614	.364	.742	.433
All	.538	.387	.643	.451

NOTE: Ratios are based on 1982 median civilian earnings adjusted by the 1983 CPI and 1983 military pay tables. All special pay is assumed to be inflation protected. Earnings ratios are expected earnings ratios for the year following initial commitment.

Table 31

PREDICTED INITIAL RETENTION OF FY1980–FY1982 VOLUNTEER ACCESSIONS ENTERING IN GRADES 03 AND 04 AT TWO SPECIAL PAY LEVELS

Specialty Group	Predicted Retention Probabilities			
	03		04	
	Current Pay	Current Pay + $10,000	Current Pay	Current Pay + $10,000
Hospital-based	.43	.52	.70	.75
Subspecialists	.21	.28	.46	.52
Surgeons/ob-gyn	.18	.24	.37	.43
Primary care/psychiatrists	.28	.35	.44	.51

Increasing special pay by $10,000 raises average retention about 17 percent, although the change in retention varies between groups. A $10,000 increase in military earnings raises the earnings ratio by 18 percent (for subspecialists and surgeons/ob-gyns) to 20 percent (for primary care/psychiatrists and hospital-based physicians). Rough estimates of the corresponding increases in retention are 12 percent for hospital-based physicians, 13 percent for subspecialists, 17 percent for surgeons and obstetricians, and 19 percent for primary care physicians, implying retention elasticities[5] of around .60, .72, .94, and .91, respectively.

The marginal costs per physician associated with a $10,000 increase in special pay are given in Table 32. As shown before, a $10,000 increase in special pay beginning in the first postcommitment year would increase overall retention by around 17 percent. In this cohort, 8 to 10 additional physicians are predicted to be retained: five primary care physicians and psychiatrists, two surgeons and obstetricians, one subspecialist, and one hospital-based physician. The total marginal cost of retaining the nine additional physicians is $604,340 per year. This amounts to an average marginal cost of $70,468 per additional physician retained, about $17,000 more than the starting military pay of $53,291 for a board certified physician entering in Grade 04, in a shortage specialty.

Table 32

MARGINAL COST PER ADDITIONAL PHYSICIAN
RETAINED WITH A $10,000 BONUS
(POSTCOMMITMENT) BY SPECIALTY

Bonus Paid To	Annual Marginal[a] Cost per Physician
Hospital-based	$93,235
Subspecialists	87,457
Surgeons/ob-gyn	68,685
Primary care/psychiatrists	62,753
All specialties	70,468

[a]Cost estimates are given in 1983 dollars.

[5]These elasticities represent arc elasticity as opposed to point elasticities, which represent the percentage change in retention due to a very small percentage change in the earnings ratio at a given point on the supply curve.

Instead of an overall increase in special pay, suppose the bonus were to go only to physicians in shortage specialties. For example, paying the bonus to surgeons and obstetricians only would add the two surgeons at a total marginal cost of only $150,000 or about one-quarter of the cost of the alternative scenario of an overall increase in special pay. These results imply that if the Air Force is contemplating an increase in physician earnings, a policy of increasing shortage specialty pay might be more cost effective for meeting procurement goals than an increase in the nontargeted components of special pay.

Another factor to be considered in this context is how a selective increase in earnings might be used to retain physicians with attributes which the Air Force considers more desirable. Suppose the Air Force favors younger, recently trained board certified surgeons to those without board or to those who are older. Table 33 indicates that for board certified surgeons or obstetricians who enter as captains, a $10,000 earnings increase would raise average initial retention by 35 percent, the largest predicted increase of any group examined. The predicted retention increase for those who enter as majors is 17 percent.

To summarize, higher military earnings appear to have substantial effects on the initial retention of volunteer physicians. The size of the effect differs by specialty group. If a pay increase is contemplated, a military pay policy should be considered which rewards the most needed specialties and/or attributes, such as board certification.

Table 33

PREDICTED INITIAL RETENTION OF BOARD CERTIFIED VOLUNTEERS
ENTERING AS CAPTAINS OR MAJORS AT TWO
SPECIAL PAY LEVELS

Specialty Group	Predicted Retention Probabilities			
	03		04	
	Current Pay	Current Pay + $10,000	Current Pay	Current Pay + $10,000
Hospital-based	.42	.50	.61	.68
Subspecialists	—	—	.46	.52
Surgeons/ob-gyn	.14	.19	.35	.41
Primary care/psychiatrists	.23	.29	.44	.50

Long-Term Retention

The ten-year retention rates for volunteer physicians are predicted to be between .20 and .40 under current pay provisions and between .25 and .45 with the $10,000 increase in special pay.

Table 34 shows the attrition profile of the cohort of FY1980–FY1982 volunteer accessions under the two special pay levels.

Long-term retention rates for the four specialty groups under the two bonus levels are shown in Table 35. An increase in special pay is predicted to have the greatest effect on the career retention of surgeons, obstetricians, and primary care physicians. Career retention of subspecialists does not appear to be affected although the initial predicted response to the increase was a 12 percent increase in retention.

Based on the attrition table, the expected years of service for the FY1980–FY1982 volunteer accessions by specialty and two special pay levels were calculated in Table 36. In spite of the differences in initial retention, long-term retention of the primary care group and the

Table 34

PREDICTED ATTRITION OF FY1980–FY1982 VOLUNTEER ACCESSIONS
(Number of physicians)

No Change in Special Pay

Specialty Group	Number of Accessions	Years Served									
		≥ 1	≥ 2	≥ 3	≥ 4	≥ 5	≥ 6	≥ 7	≥ 8	≥ 9	≥ 10
Hospital-based	17	17	16	15	10	10	10	9	9	9	9
Subspecialists	10	9	9	8	4	3	3	3	3	3	3
Surgeons/ob-gyn	38	35	34	31	13	10	10	9	9	9	9
Primary care/psych.	69	67	63	60	25	21	19	18	18	18	17
All	134	128	122	114	52	44	42	40	39	39	39

Special Pay + $10,000

Specialty Group	Number of Accessions	Years Served									
		≥ 1	≥ 2	≥ 3	≥ 4	≥ 5	≥ 6	≥ 7	≥ 8	≥ 9	≥ 10
Hospital-based	17	17	16	15	11	11	11	10	10	10	10
Subspecialists	10	9	9	8	5	4	4	3	3	3	3
Surgeons/ob-gyn	38	35	34	31	15	12	12	11	11	11	11
Primary care/psych.	69	67	63	60	30	25	23	23	22	22	21
All	134	128	122	114	61	52	50	47	46	45	45

Table 35

PREDICTED LONG-TERM RETENTION OF FY1980–FY1982 VOLUNTEER ACCESSIONS WITH THREE-YEAR COMMITMENTS

Specialty Group	Predicted 10-Year Retention Probabilities		
	No Change in Special Pay	Special Pay + $10,000	% Change in Retention
Hospital-based	.52	.59	14
Subspecialists	.30	.30	0
Surgeon/ob-gyn	.24	.29	21
Primary care/psych.	.25	.30	20
All	.29	.34	17

Table 36

EXPECTED YEARS OF SERVICE FOR FY1980–FY1982 VOLUNTEER ACCESSIONS WITH THREE-YEAR COMMITMENTS

Specialty Group	Expected Years of Service	
	Current Special Pay	Special Pay + $10,000
Hospital-based	9.40	10.47
Subspecialists	7.10	7.40
Surgeons/ob-gyn	6.39	6.97
Primary care/psych.	6.56	7.35
All	7.16	7.60

surgeons/ob-gyns is very close and significantly lower than for subspecialists and hospital-based specialists. Selectively increasing shortage specialty pay by $10,000 may largely eliminate this imbalance for all but the hospital-based group (see Table 35).

The Air Force has estimated [30] that the average expected length of service for FY1980 and FY1981 volunteer accessions will be 10.1 and 9.68, respectively, considerably higher than the average predicted length of service of around seven years for this cohort. The two estimates vary for two reasons. First, the estimates in this study are based on individual volunteer physician's retention behavior, i.e., the estimated retention functions control for the individual physician's personal and service characteristics. The Air Force predictions are based on average retention rates which do not account for variation in physician characteristics. The difference in the long-term retention

and expected years of service predictions is primarily due to the difference in the four-year retention probabilities which measure retention one year beyond the end of the commitment. The average four-year retention rate for all FY1981 volunteer accessions estimated by the Air Force is .573,[30, p. 19] significantly higher than the behavioral rate of .387 predicted by this study for FY1980–FY1982 volunteer accessions.[6]

Second, the Air Force bases its prediction on a 20-year projection of continuation rates, clearly not supported by actual volunteer retention experience.

As stated earlier, about one-half of the volunteers are not eligible to remain on active duty for 20 years because they are over 40 years old when they join.[7] The length of service estimates in this study are based on a more conservative 15-year projection, assuming that physicians who remain for at least ten years (seven years past their commitment) would remain for 15 years. However, even though there is evidence that retention stabilizes rapidly beyond the initial commitment as physicians enter the career force, it should be noted that beyond six or seven years of service, volunteer continuation rate estimates cannot be based on actual observable experience but represent the Air Force's best guess based on the experience of draft era career physicians. As stated before, the continuation rate for year groups 6, 7, 8, and 9 in this study are also based on these Air Force continuation rates of .95, .98, .99, and .99, respectively. Accordingly, this study's prediction of an average of 7.16 years of service per physician, although significantly lower than the Air Force's predicted average of about ten years, may still misestimate volunteers' actual expected length of service. In summary, however, because this study's predictions are based on behavioral estimates rather than averages, and because these predictions represent a more conservative approach toward service eligibility, they are likely to be more realistic.

The discussion now turns to the implication of the long-term retention outlook and the potential role of the volunteer program in the context of overall physician force planning.

Implication for Physician Force Planning

The short-term and long-term career retention prospects for volunteer accessions are related to future physician accession require-

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[6]Part of this difference can be explained by the four-year obligors who are included in the Air Force four-year retention average. However, the five-year retention rate is still substantially higher at .439, compared to .325 predicted by this study.

[7]Of the 134 FY1980–FY1982 accessions, 54, or 40 percent, will not exceed 15 years of service and 36, or 25 percent, will not exceed 10 years of service based on their age at entry.

ments. Table 37 shows the average number of volunteer accessions per year for FY1977–FY1981 by specialty. At these levels of volunteer accessions, substantial shortages remain in the subspecialists and surgeons/ob-gyn groups.

The authorized endstrength for FY1987 and beyond calls for a total of 3513 physicians in the four groups. Table 38 shows the specialty breakdown. The FY1987 authorizations call for a significant increase in endstrength for all specialties, with the largest increase in the subspecialty group.

Suppose the Air Force were to recruit all physicians directly from the civilian sector. Based on the above predicted retention profiles for FY1980–FY1982 volunteers, an average of 514 volunteer accessions[b]

Table 37

AVERAGE NUMBER OF VOLUNTEER GAINS
PER YEAR (FY1977–FY1981)
BY SPECIALTY

Specialty Group	Average Annual Gains
Hospital-based	23
Subspecialists	15
Surgeons/ob-gyn	42
Primary care/psychiatrist	142
All	225

Table 38

FY1987 AUTHORIZED PHYSICIAN ENDSTRENGTH
BY SPECIALTY GROUP

Specialty Group	Endstrength FY1982 Authorized	Actual	Estimated Endstrength FY1987 Authorized	% Change in Authorized Endstrength FY1982–1987
Hospital-based	277	294	381	37%
Subspecialists	361	289	563	56%
Surgeons/ob-gyn	478	380	523	9%
Primary care/psychiatrist	1687	1815	2052	22%
All[a]	2803	2778	3513	25%

SOURCE: Ref. 32.
[a]Excludes: Graduate Medical Education (833), Executive Medicine (43), Physical Medicine (6), Other (9).

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[b]The Air Force estimates between 500 and 650 (including Medical Education), see Ref. 1.

annually would be needed to maintain the desired physician stock at 3513. A breakdown of accession requirements by specialty is given in Table 39.

Table 39 shows that if the average annual recruiting levels of volunteers for FY1977–FY1981 (see Table 37) could be maintained in the future, the Air Force might be able to recruit about one-half of their required physicians through the volunteer procurement program for all but the subspecialty group.

Table 39

VOLUNTEER ACCESSIONS REQUIRED TO MAINTAIN AUTHORIZED
ENDSTRENGTH WITH DIRECT RECRUITING AND
TWO SPECIAL PAY LEVELS

Specialty Group	Accessions Required per Year	
	Current Military Earnings	Current Earnings + $10,000 After Initial Commitment
Hospital-based	40	36
Subspecialists	79	76
Surgeons/ob-gyn	82	75
Primary care/psychiatrist	313	270
All	514	457

CONCLUDING OBSERVATIONS

The previous subsection discussed the predicted retention profiles for volunteer Air Force physicians. The results suggest that the volunteer program can be a viable and important source of physicians to the Air Force. It is flexible and has a low cost per physician accession at the current level of procurement and at current supply conditions.

At the current level of military earnings and the FY1977–FY1981 average number of 225 accessions per year, close to one-half of the authorized number of physicians (except subspecialists) might be recruited through the direct recruiting program. Because of the responsiveness of volunteers to changes in earnings, increasing military pay could further reduce the number of accessions required annually.

Expanding the scope of the volunteer program beyond average historical levels by increasing military pay might diminish and perhaps eliminate its advantage over the AFHPSP procurement program. In a recent study, Hosek [1] estimated that at an increase in military pay of

between $15,000 and $20,000 the volunteer program might lose its cost advantage over the AFHPSP. (These cost comparisons are tentative because they depend to a large extent on the as yet unknown retention behavior of AFHPSP physicians.)

Increasing the retention of all volunteers beyond the current already high levels by increasing the compensation paid to all physicians would be expensive. However, given the supply conditions for volunteers, retention of physicians in the most needed specialties could be raised through a targeted increase in the shortage specialty bonus. As shown earlier, increasing special pay for surgeons/obstetricians by $10,000 per year beginning in the first postcommitment year would increase retention by about 20 percent. Such a policy of greater variation of military earnings by specialty would more closely resemble physicians' relative civilian opportunities and it would represent a substantial cost savings over an increase in other components of military pay awarded to all physicians.

The volunteer program adds flexibility to physician procurement by allowing the Air Force to quickly fill unforeseen gaps. The drawback of relying on the volunteer program as the principal source of physicians is that its flexibility is likely to translate into uncertainty. To consistently meet Air Force manpower requirements, frequent adjustments in military earnings might be necessary to reflect the changing (and at this point uncertain) supply conditions. (The AFHPSP program, on the other hand, provides predictable numbers and types of obligated physicians at a known price each year, greatly facilitating physician manpower planning.)

The question of comparability of quality of physicians from the different procurement programs cannot be resolved by this study and needs to be addressed in the future. Quality in the military context is not only professional competence but also achievement of a desirable mix with respect to age, experience, and career potential. Reliance on any one procurement source is perhaps not an optimal strategy. However, based on the retention profiles discussed above, the volunteer program is probably at present the least desirable single-source program. Volunteer accessions to the Air Force are older than physicians procured through the scholarship program. In addition to leading to an older physician staff, more foreign physicians would be recruited and retained. Both are factors which might be of less importance in peacetime than in wartime when physician age and citizenship status may limit volunteer physicians' deployment options.

In addition, the Air Force clearly is concerned with maintaining the quality of their physician force when contemplating a change in procurement strategy. However, in the past, the Air Force has attracted

and retained few board certified volunteers and. while board certification is not the only measure of physician quality. it is one of the criteria which determine civilian opportunities. There is evidence that in a changing civilian labor market lower quality physicians will be the first to be driven out of the civilian market.[32] In turn. one might suspect that higher quality military physicians might be driven out of military practice if the professional level deteriorates.

As shown earlier, increasing the military earnings of board certified physicians substantially increased retention. The physicians most responsive to an earnings increase were board certified surgeons and obstetricians (see Table 33). Here. too. targeting pay raises (through an increase in board certified special pay) could make the volunteer program more responsive to Air Force requirements. In summary, the volunteer program has played an important role in the past. By maintaining average historical accession levels and by targeting earnings increases, the volunteer program can continue to function as a major physician procurement program without losing its advantages of low cost and flexibility.

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